Fig. 1

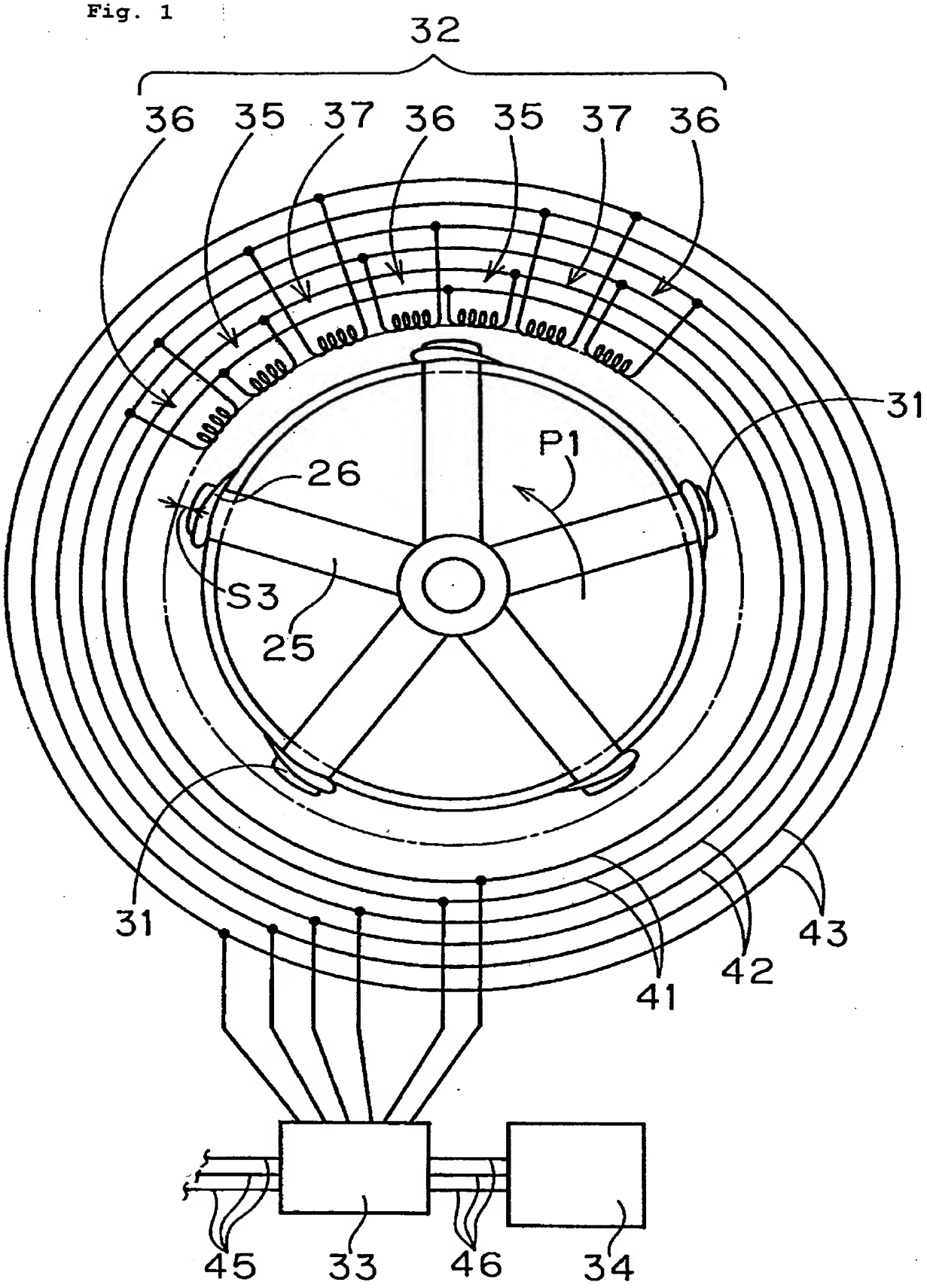


Fig. 2

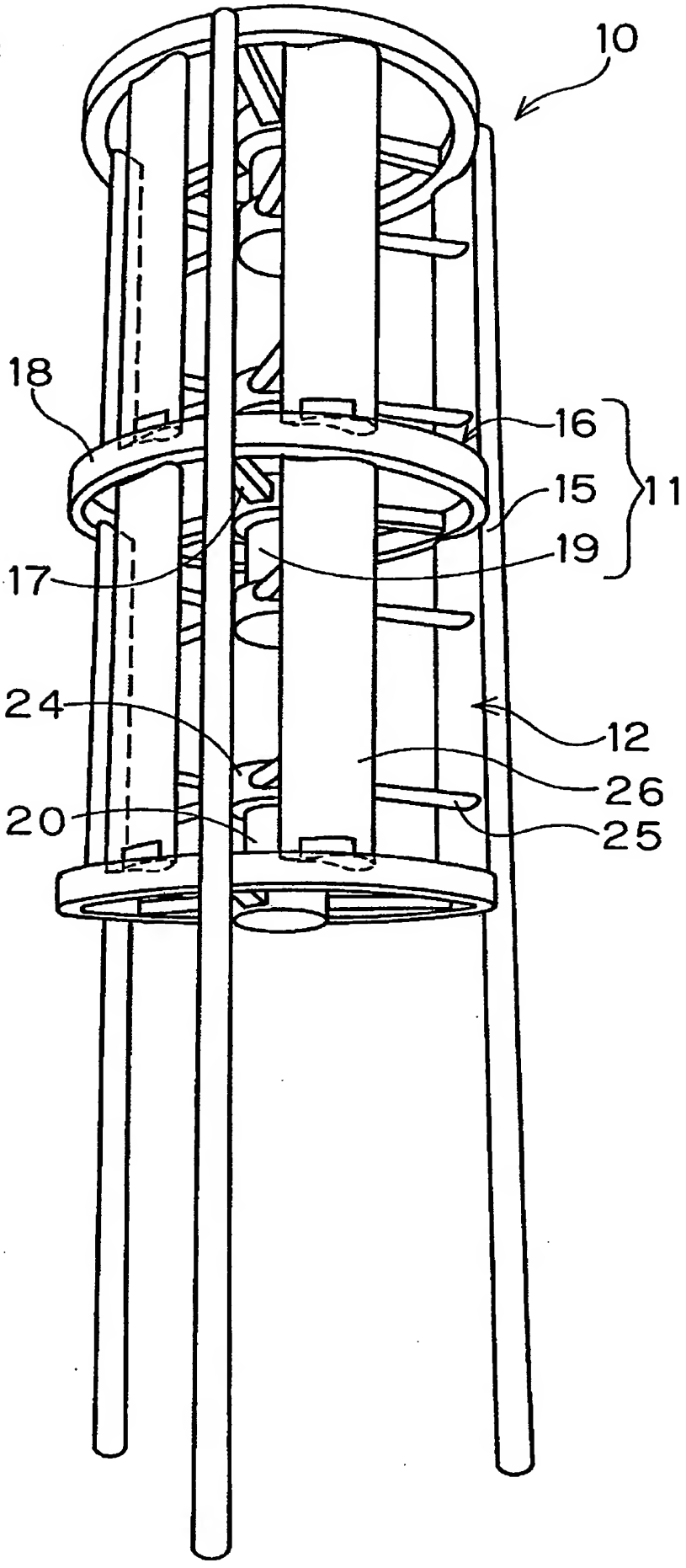


Fig. 3

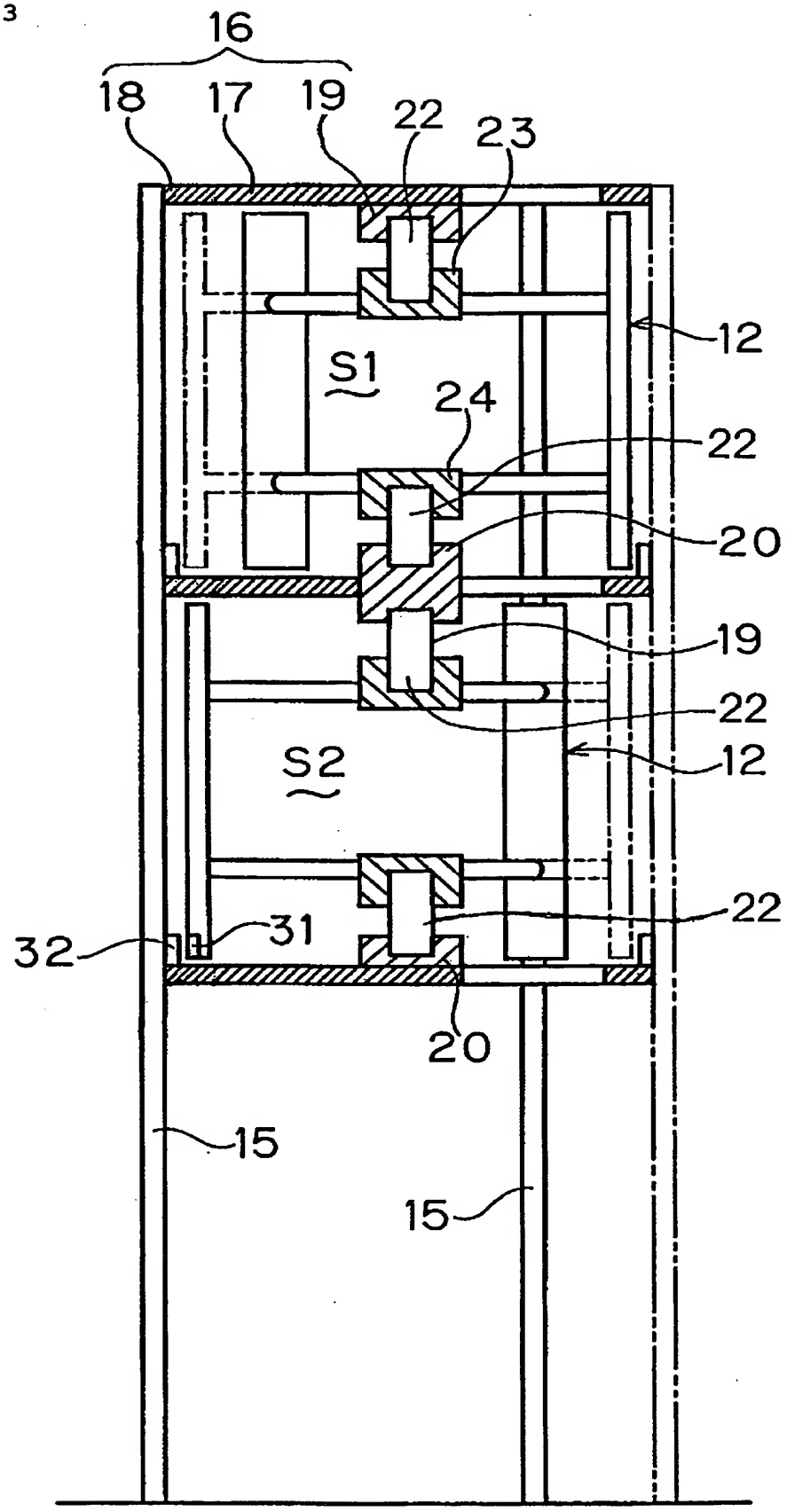


Fig. 4

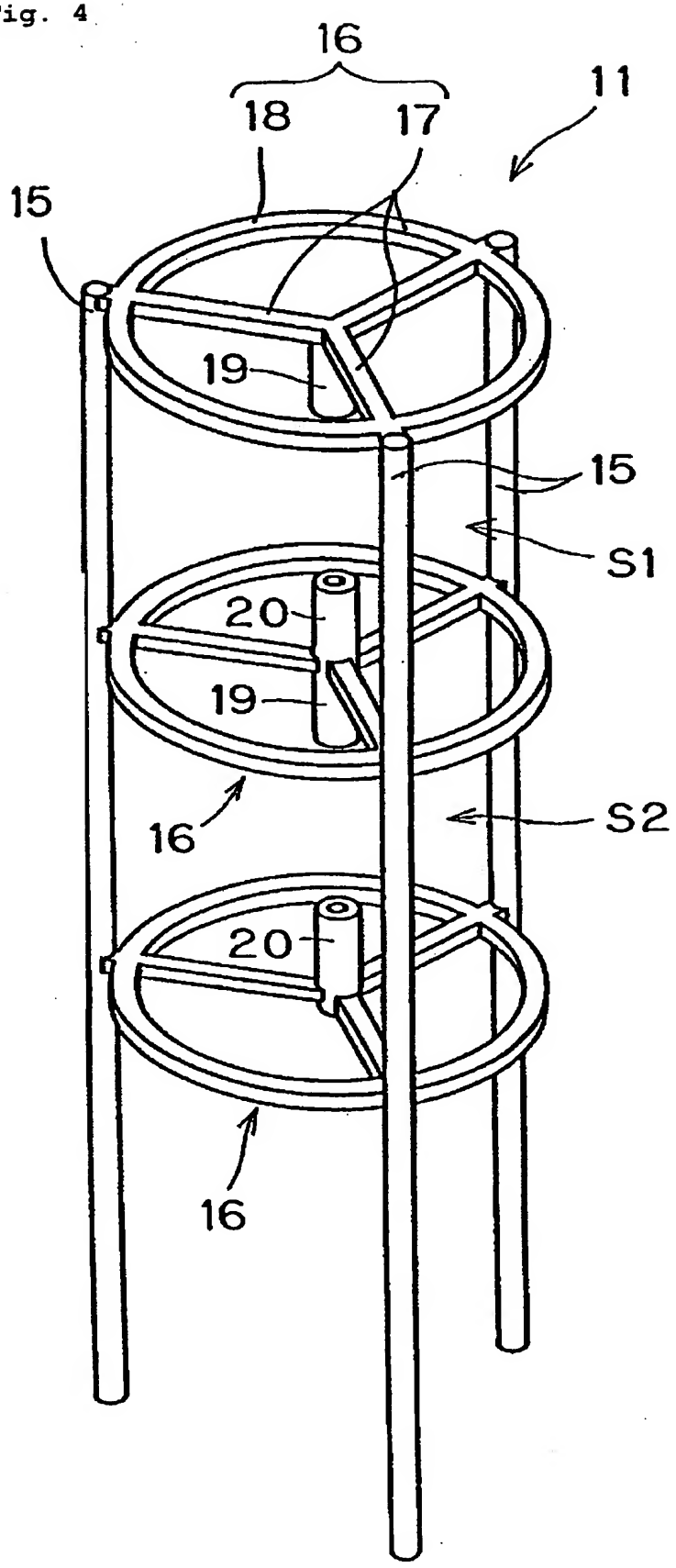


Fig. 5

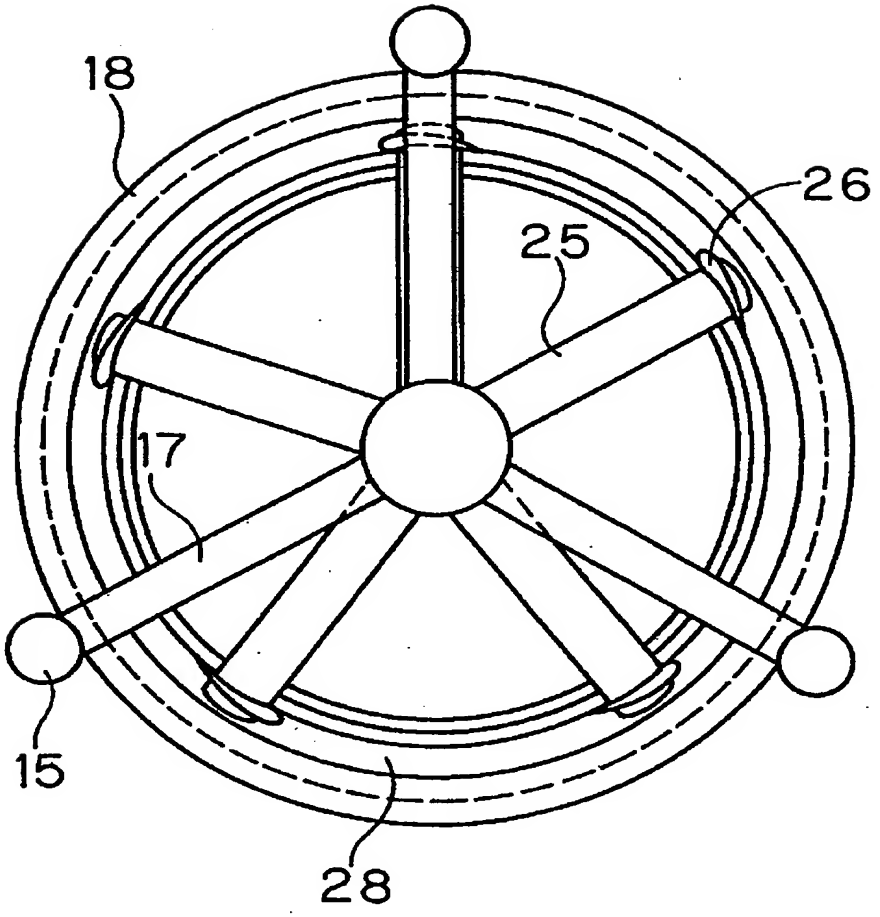


Fig. 6

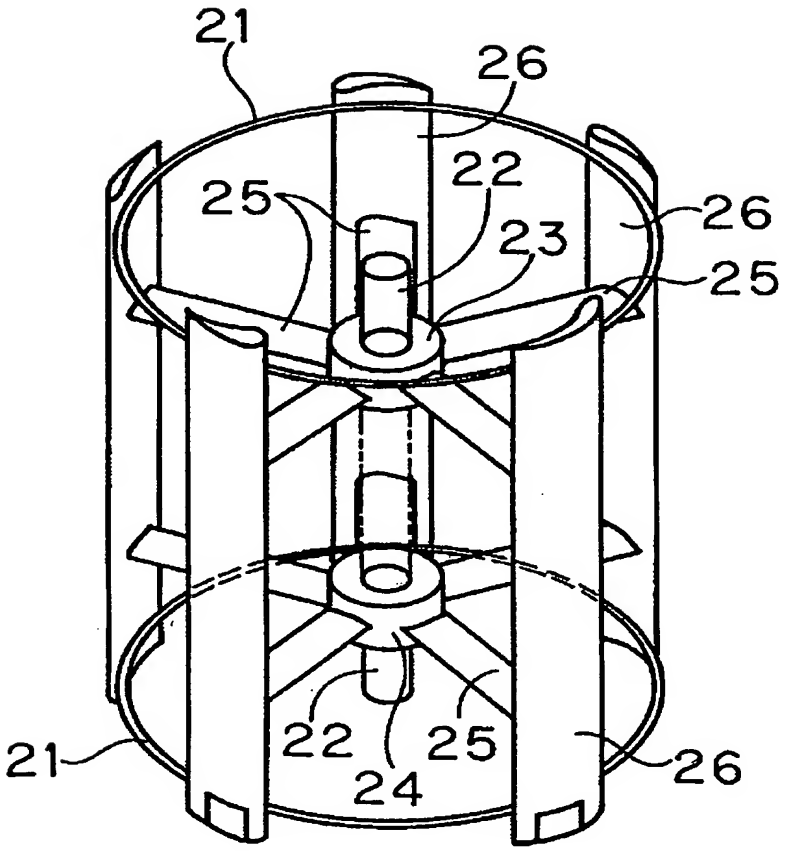


Fig. 7

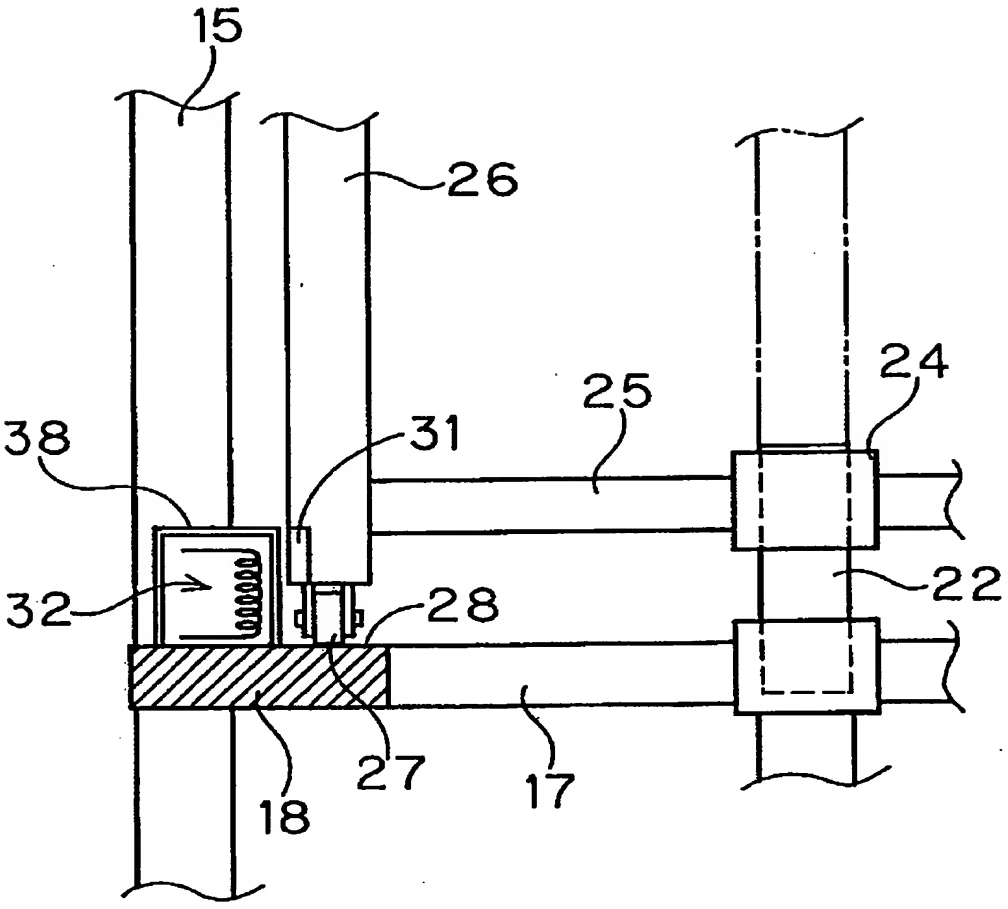


Fig. 8

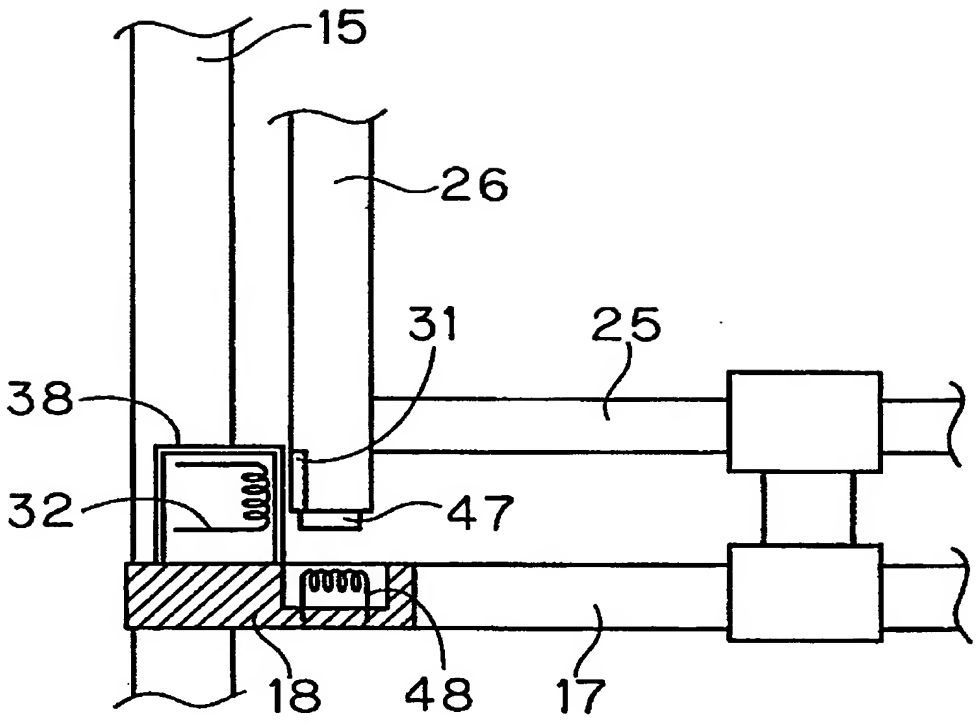


Fig. 9

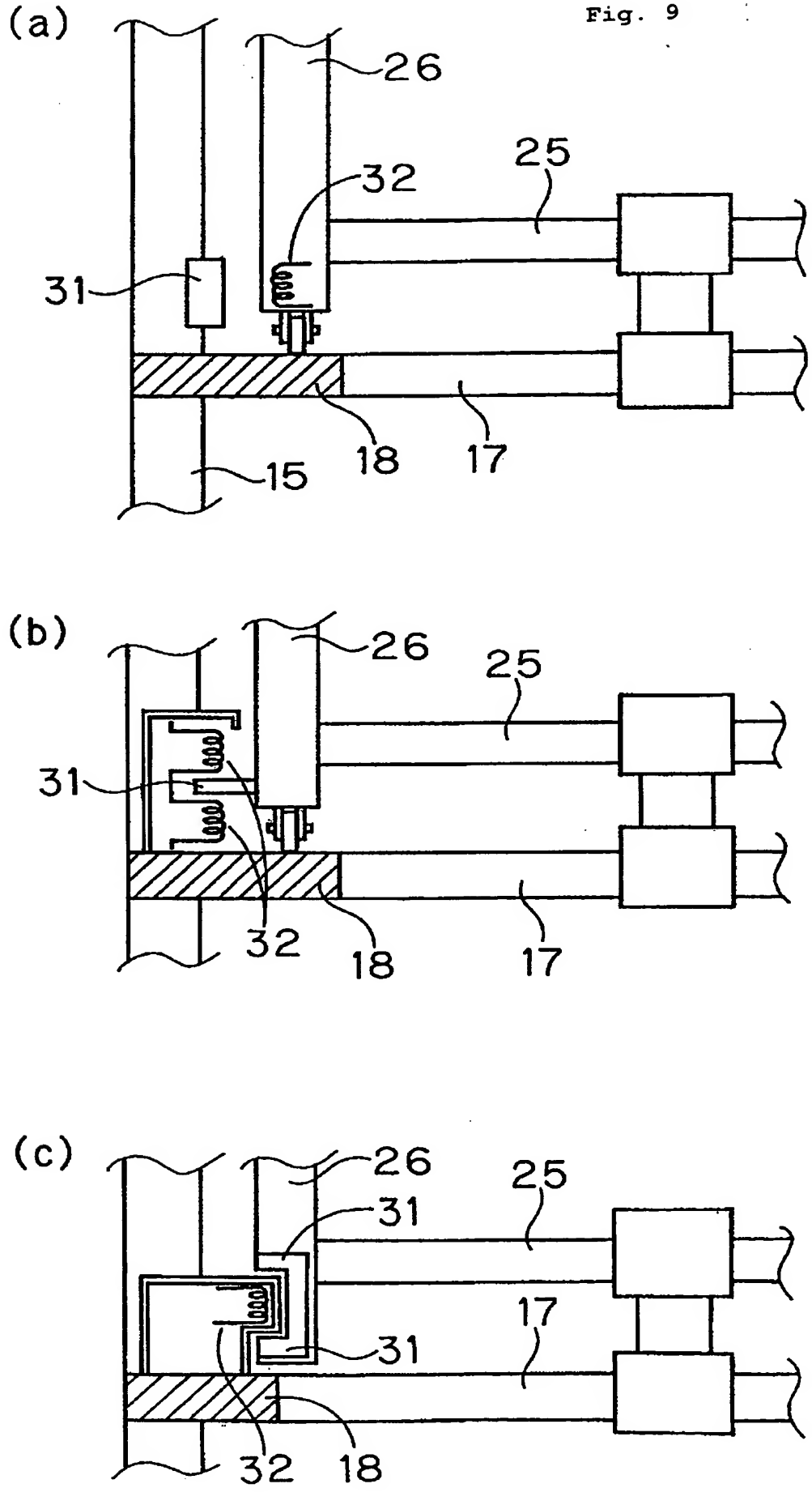


Fig. 10

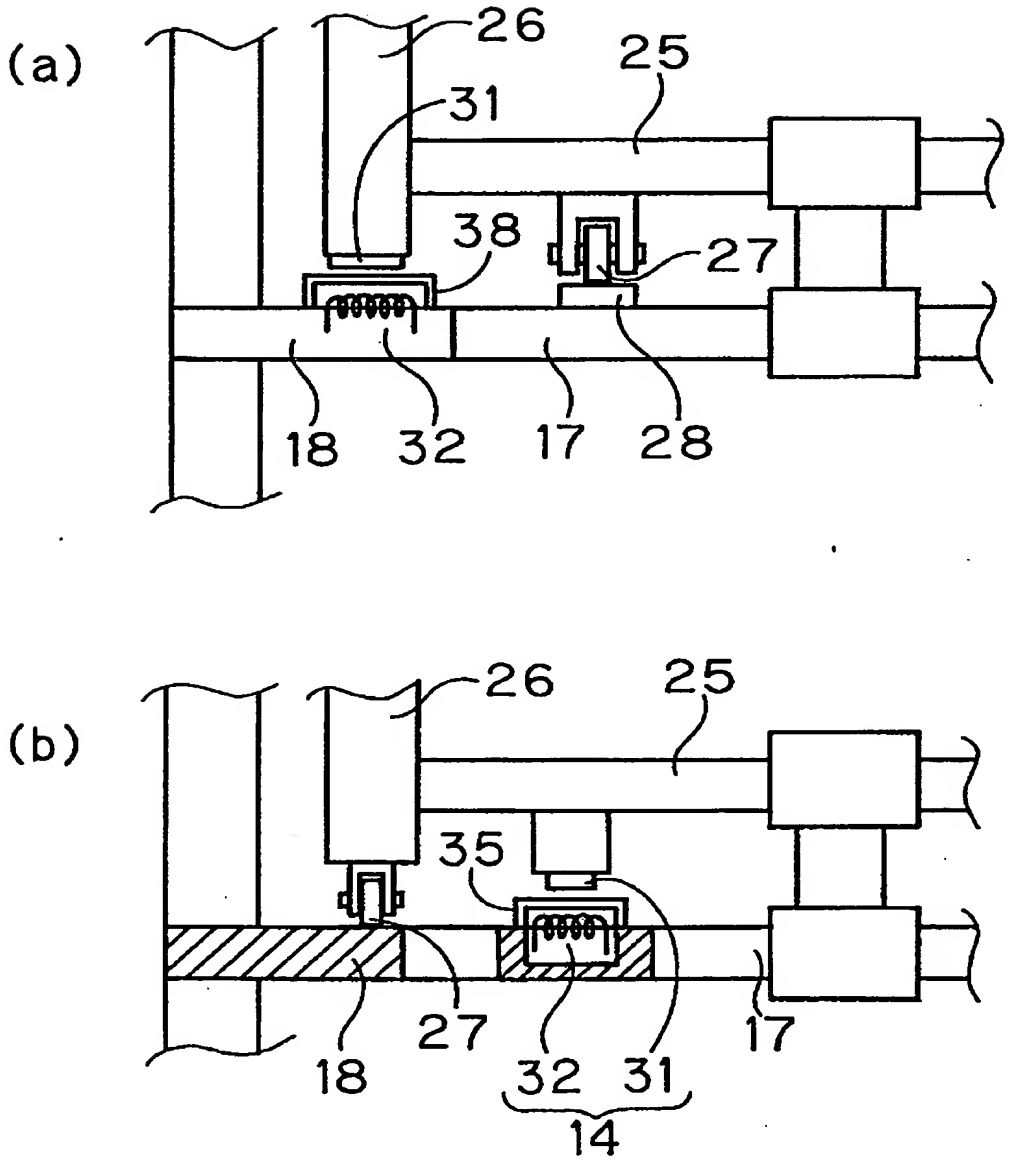


Fig. 11

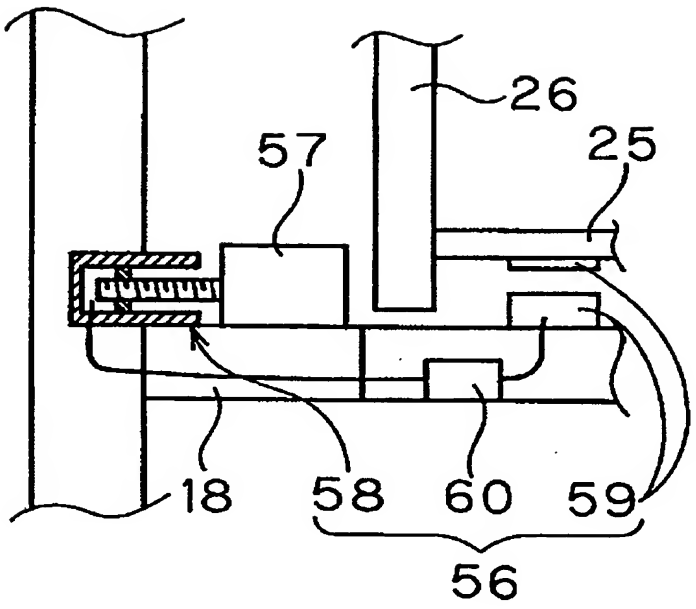


Fig. 12

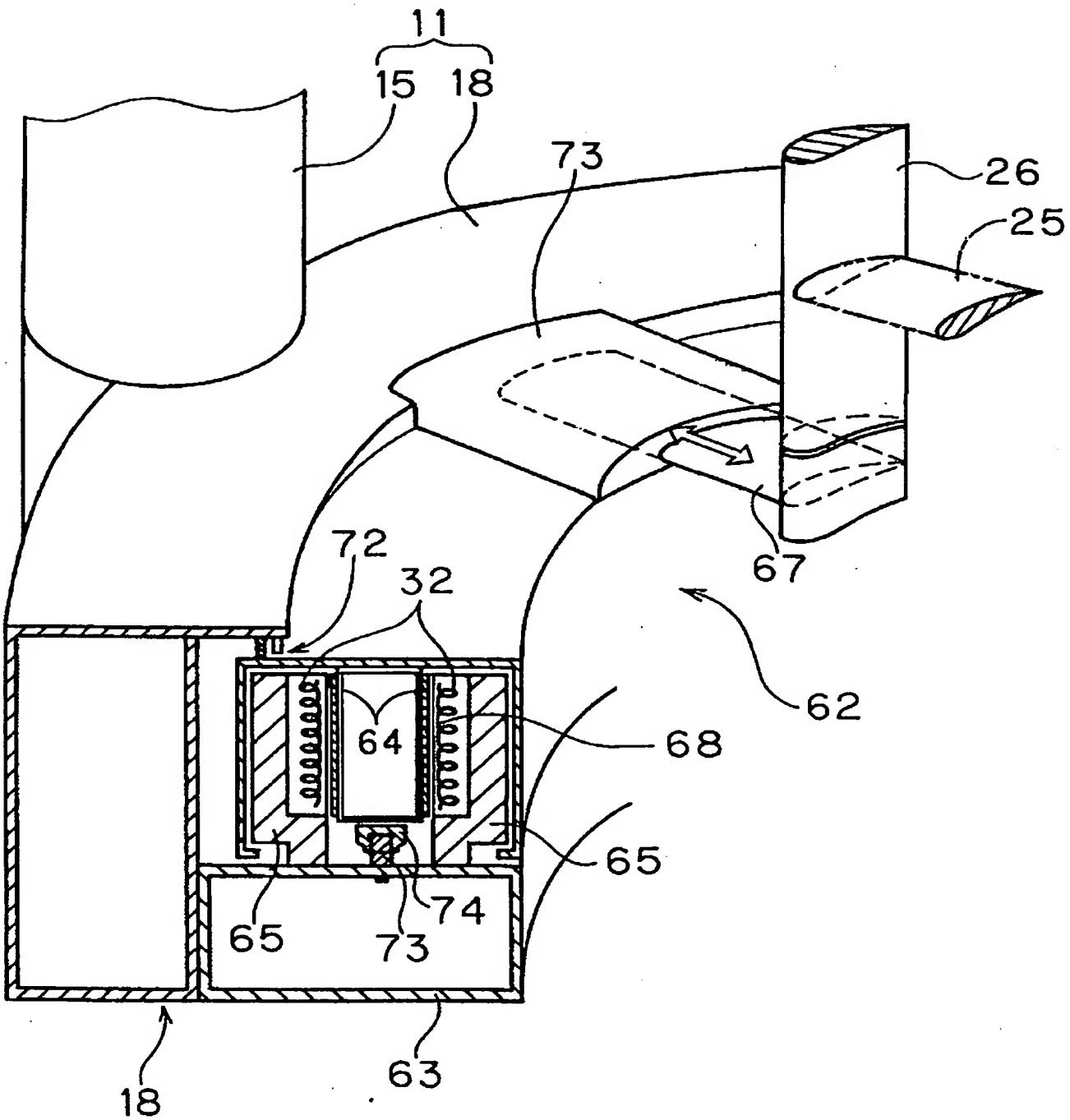


Fig. 13

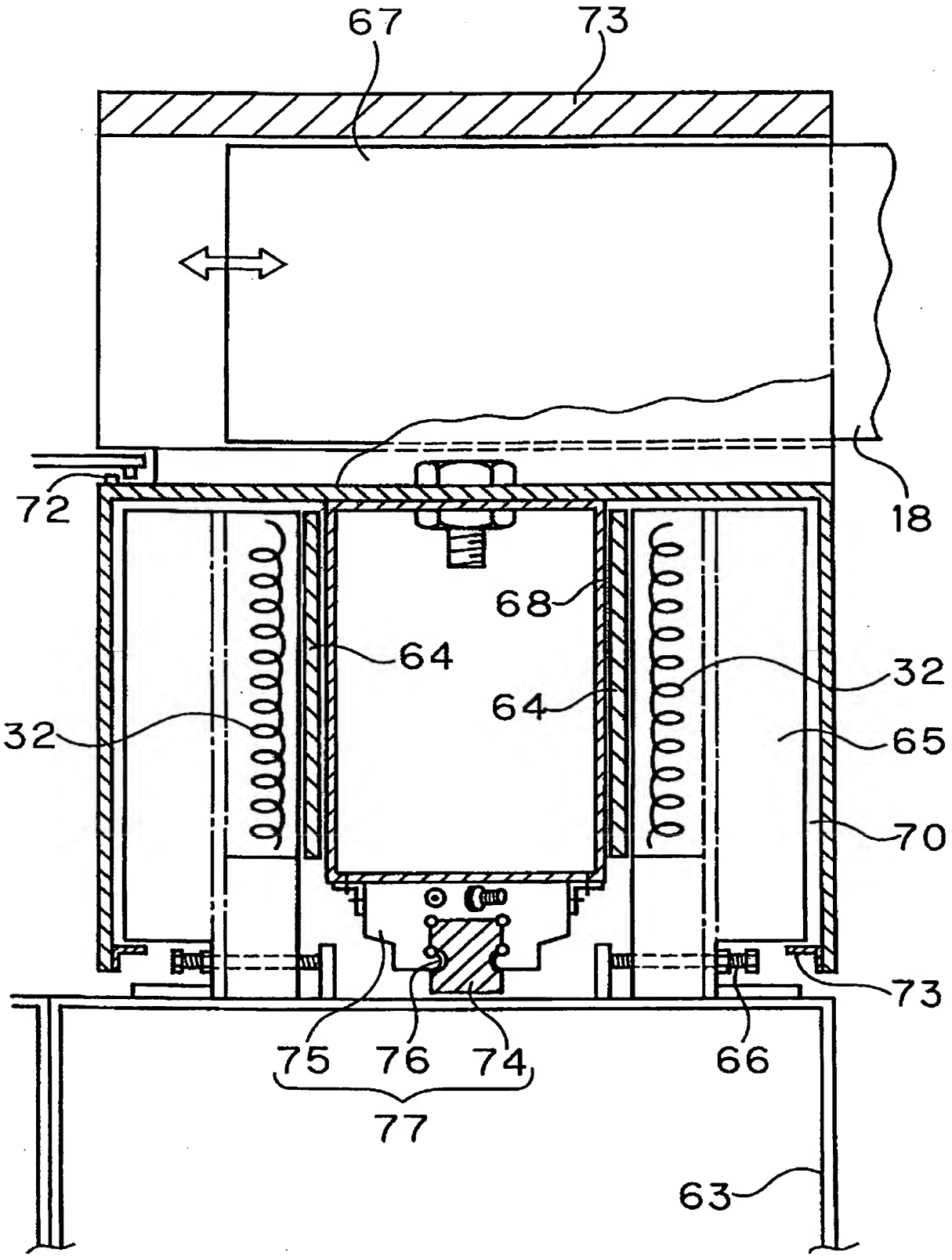
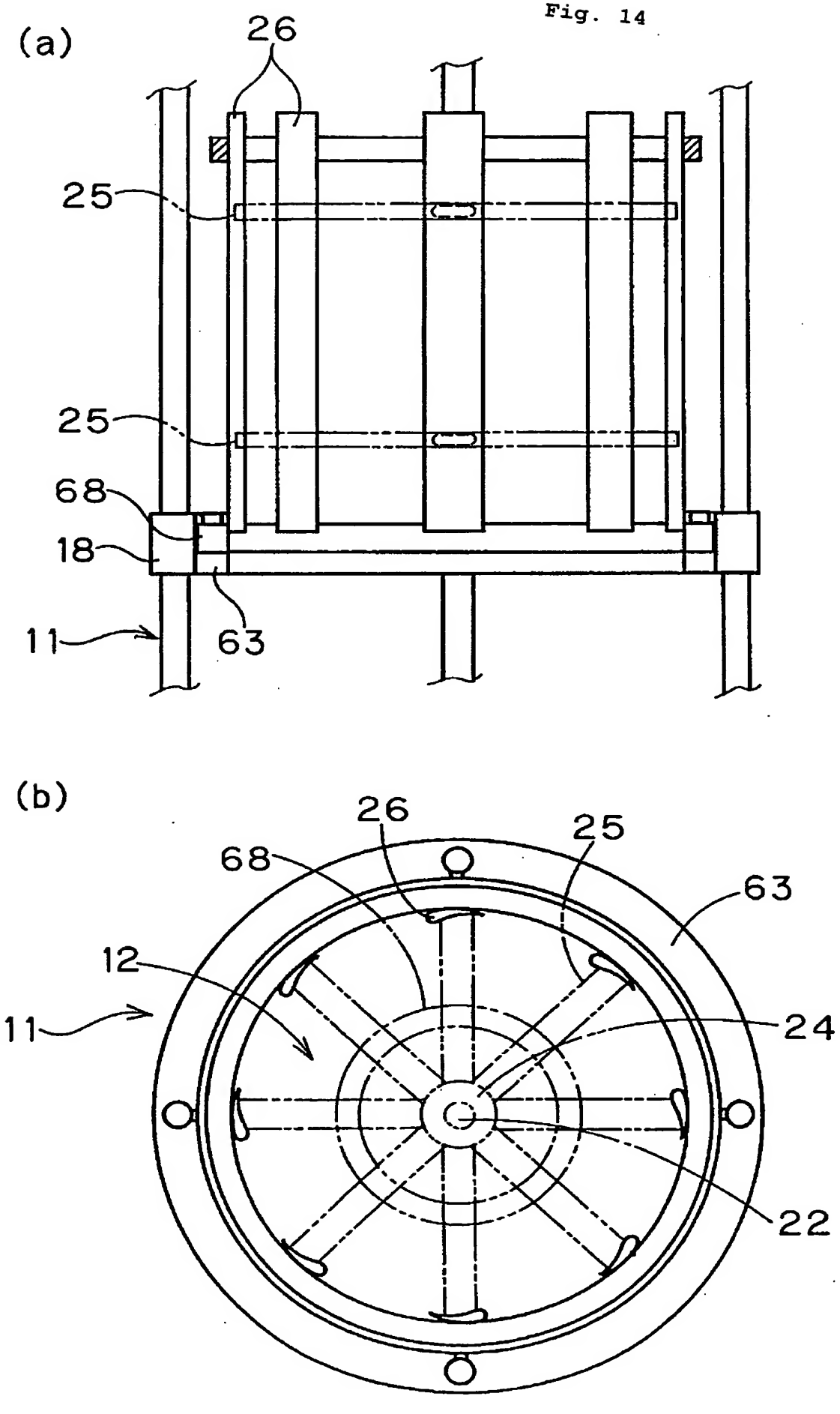


Fig. 14



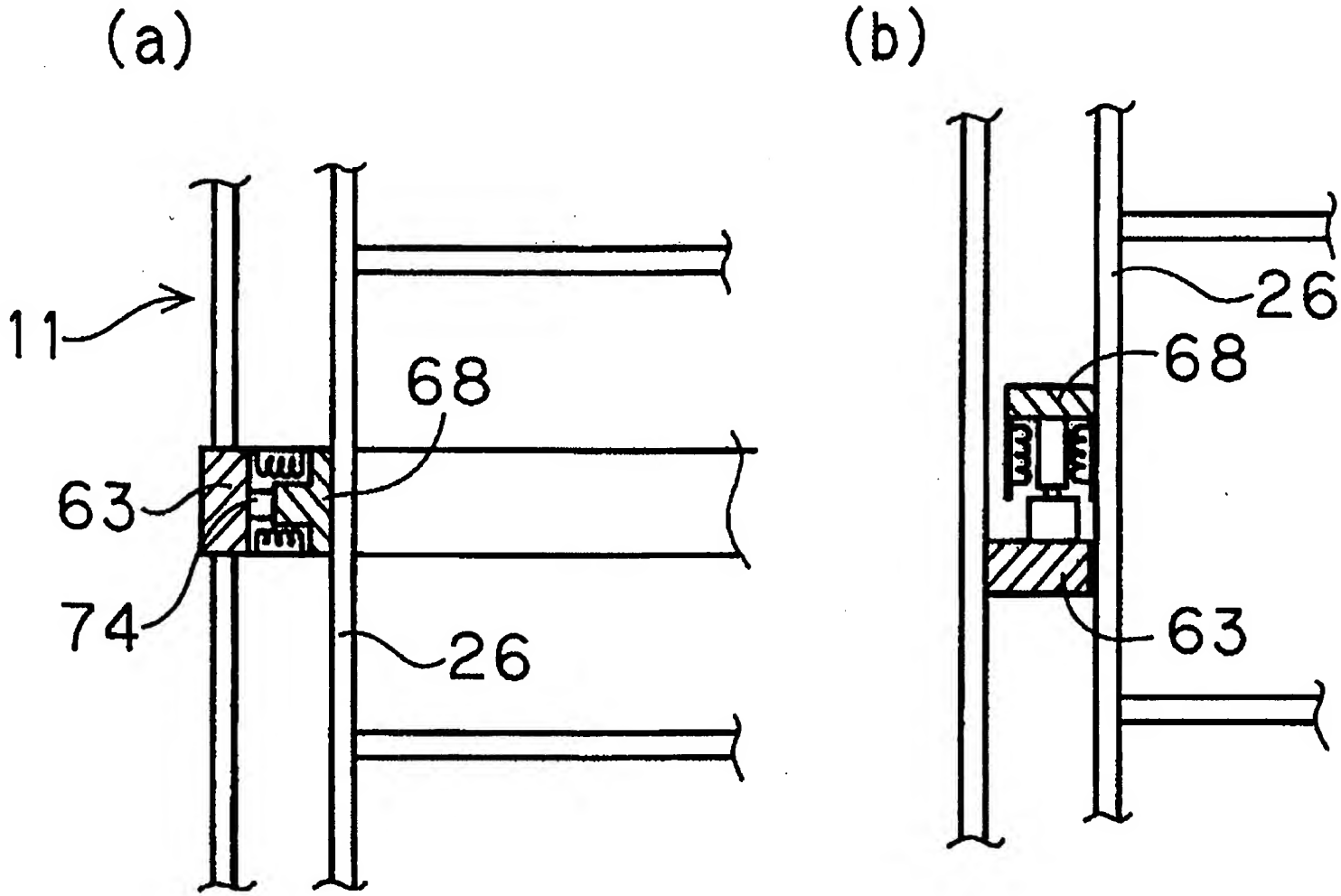


Fig. 15

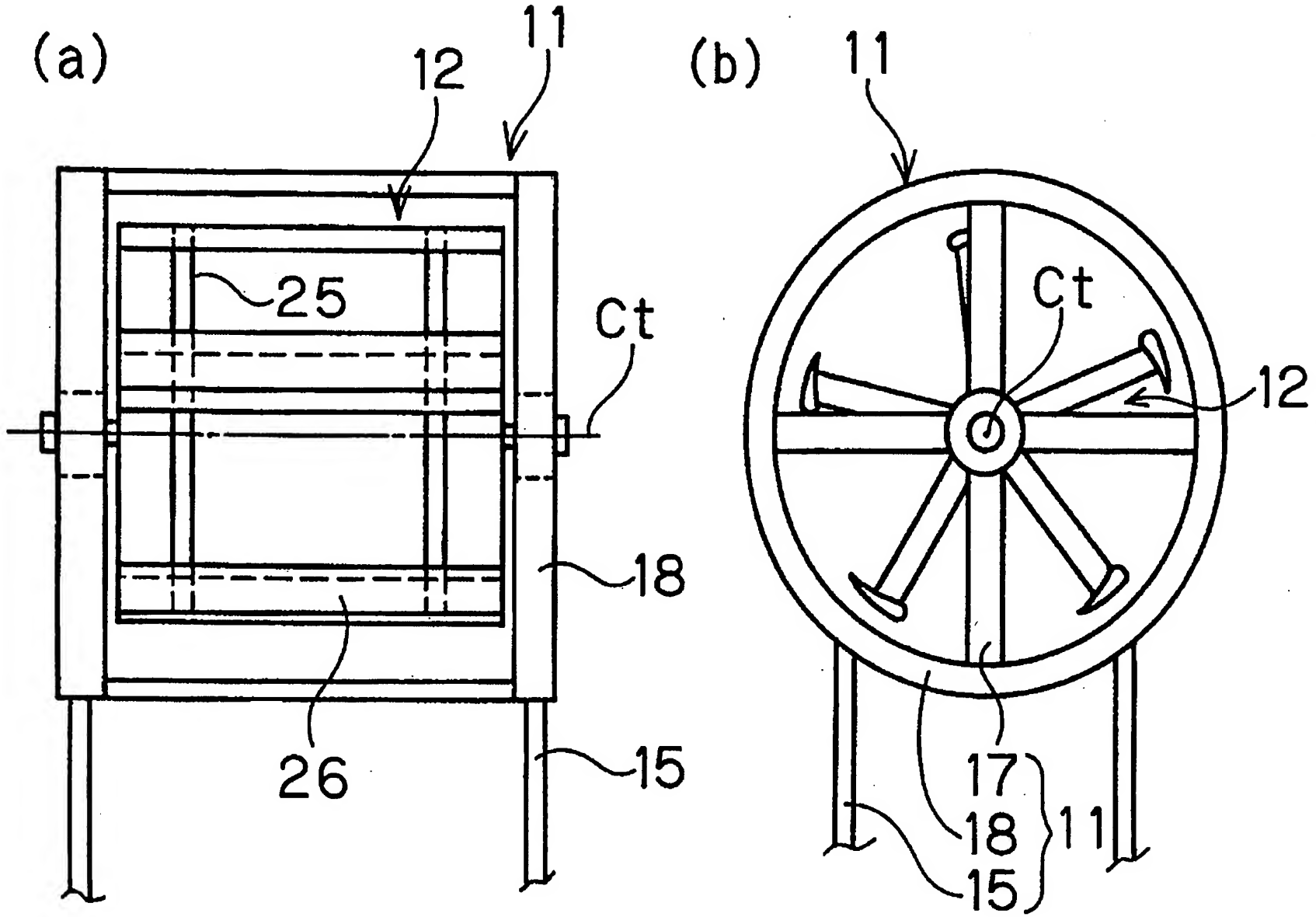


Fig. 16

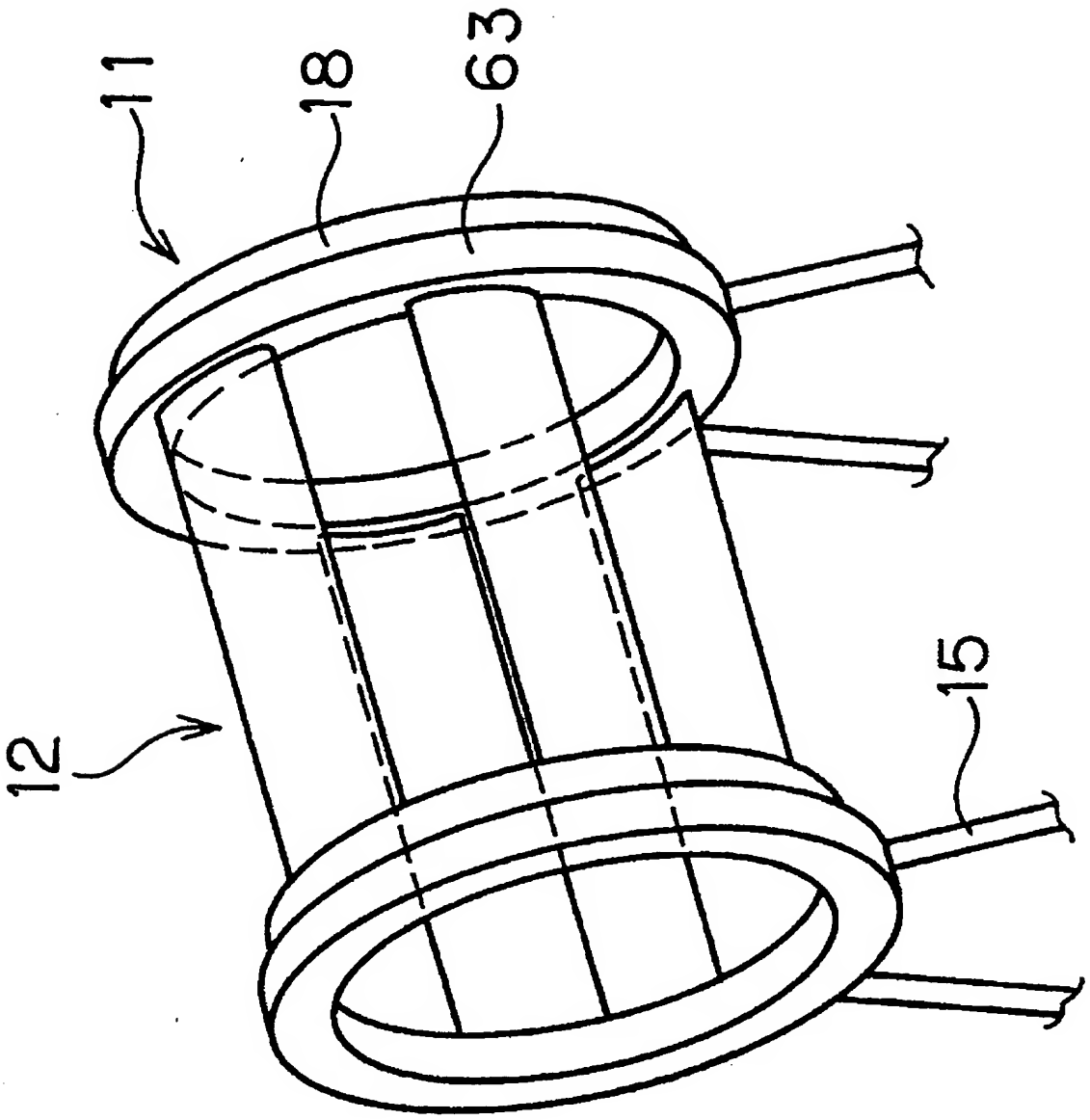


Fig. 17

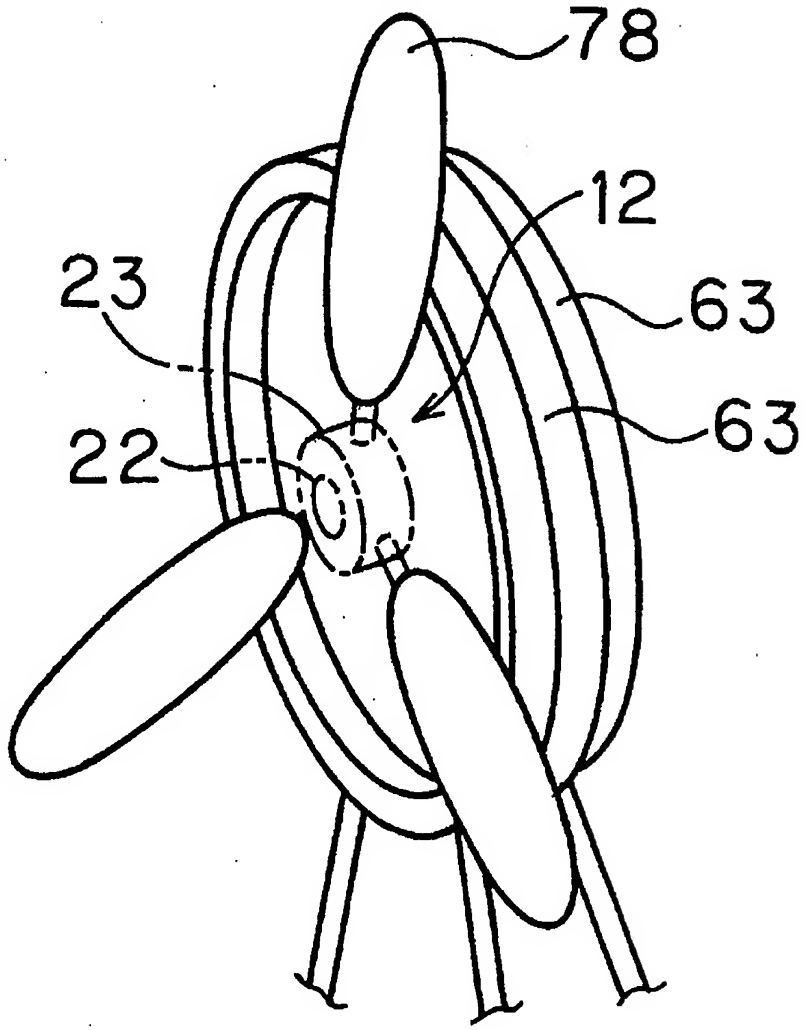


Fig. 18

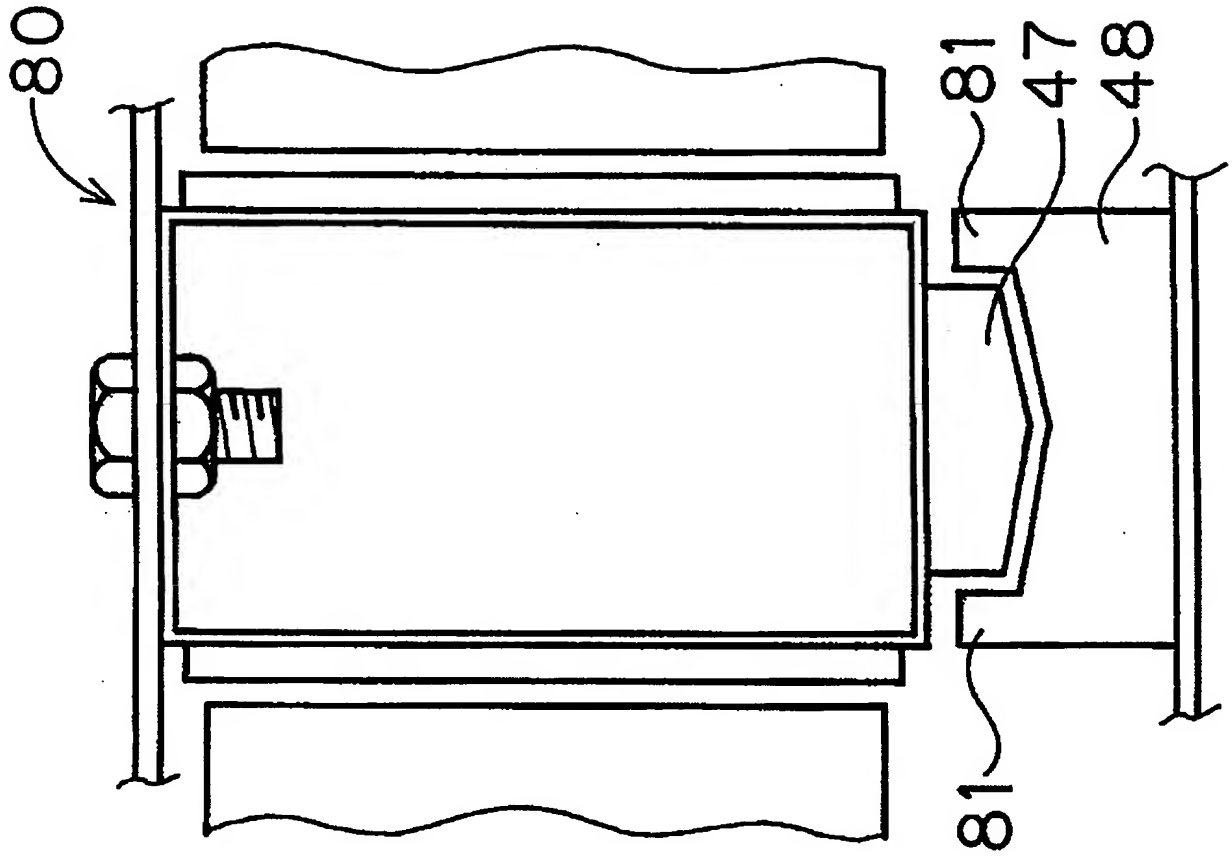
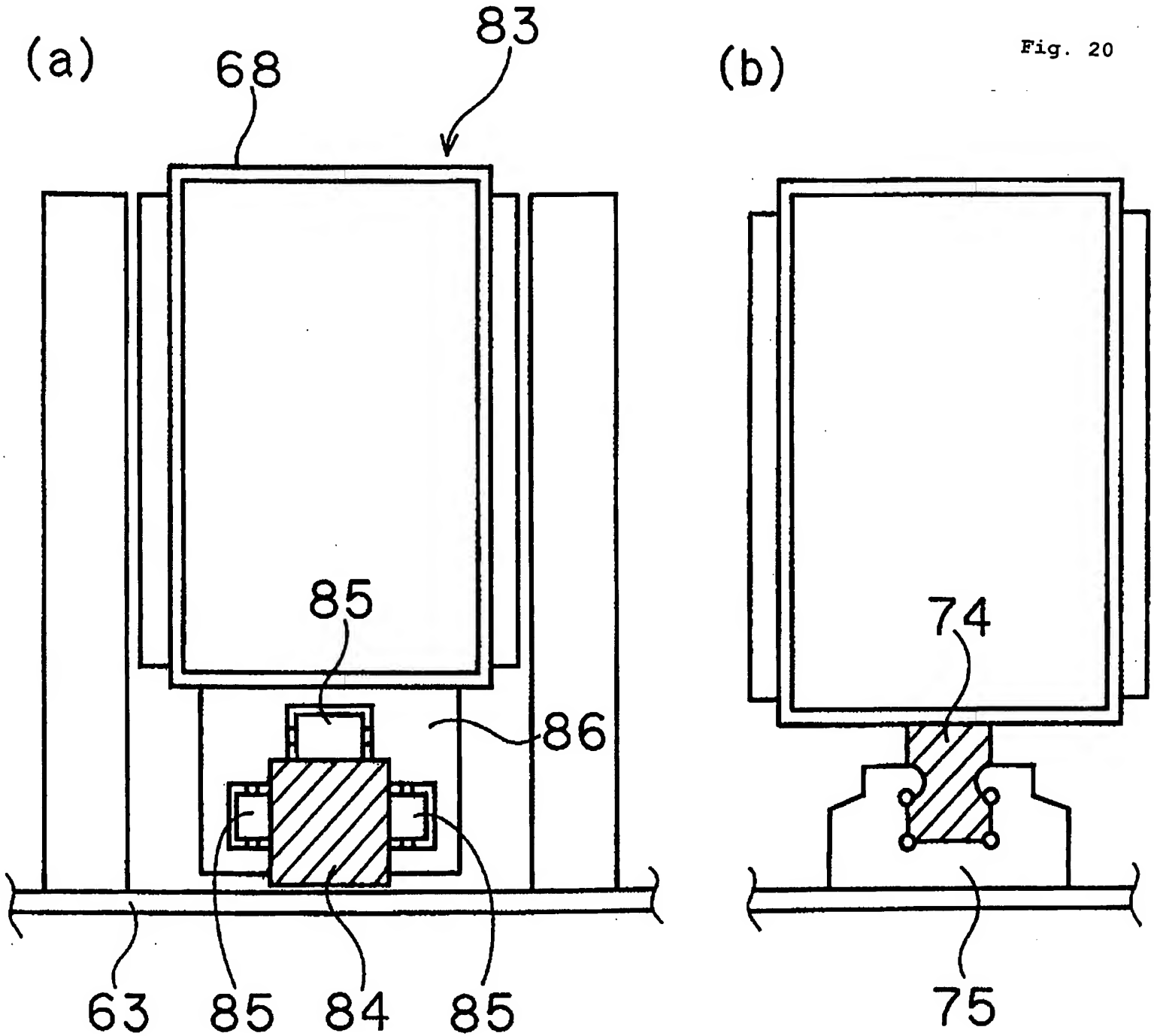


Fig. 19

Fig. 20



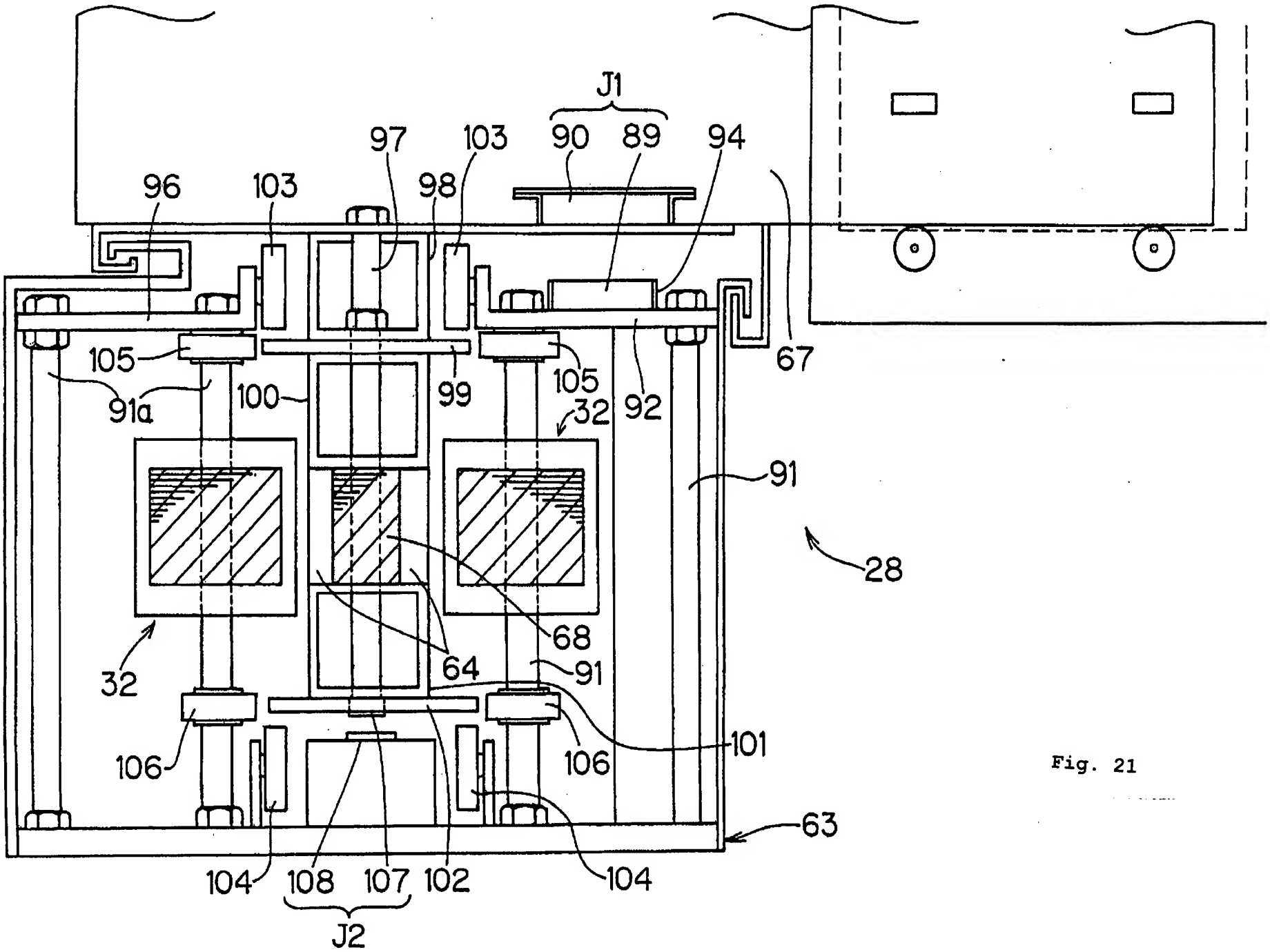
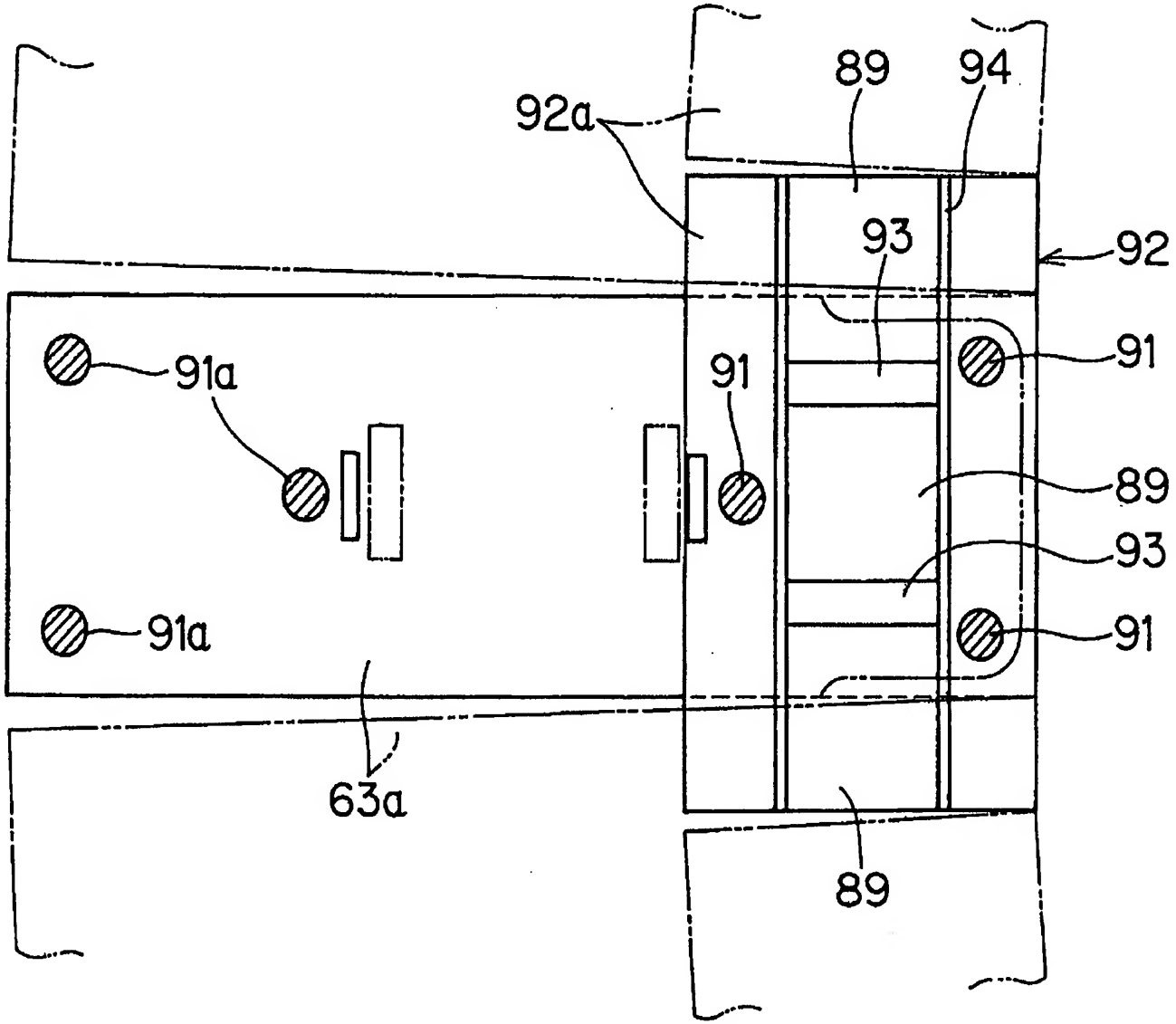

J1
90
89
94
97
103
96
103
98
105
105
67
91a
100
99
32
92
91
28
68
64
91
32
106
106
101
63
104
108
107
102
104
J2

Fig. 21

Fig. 22



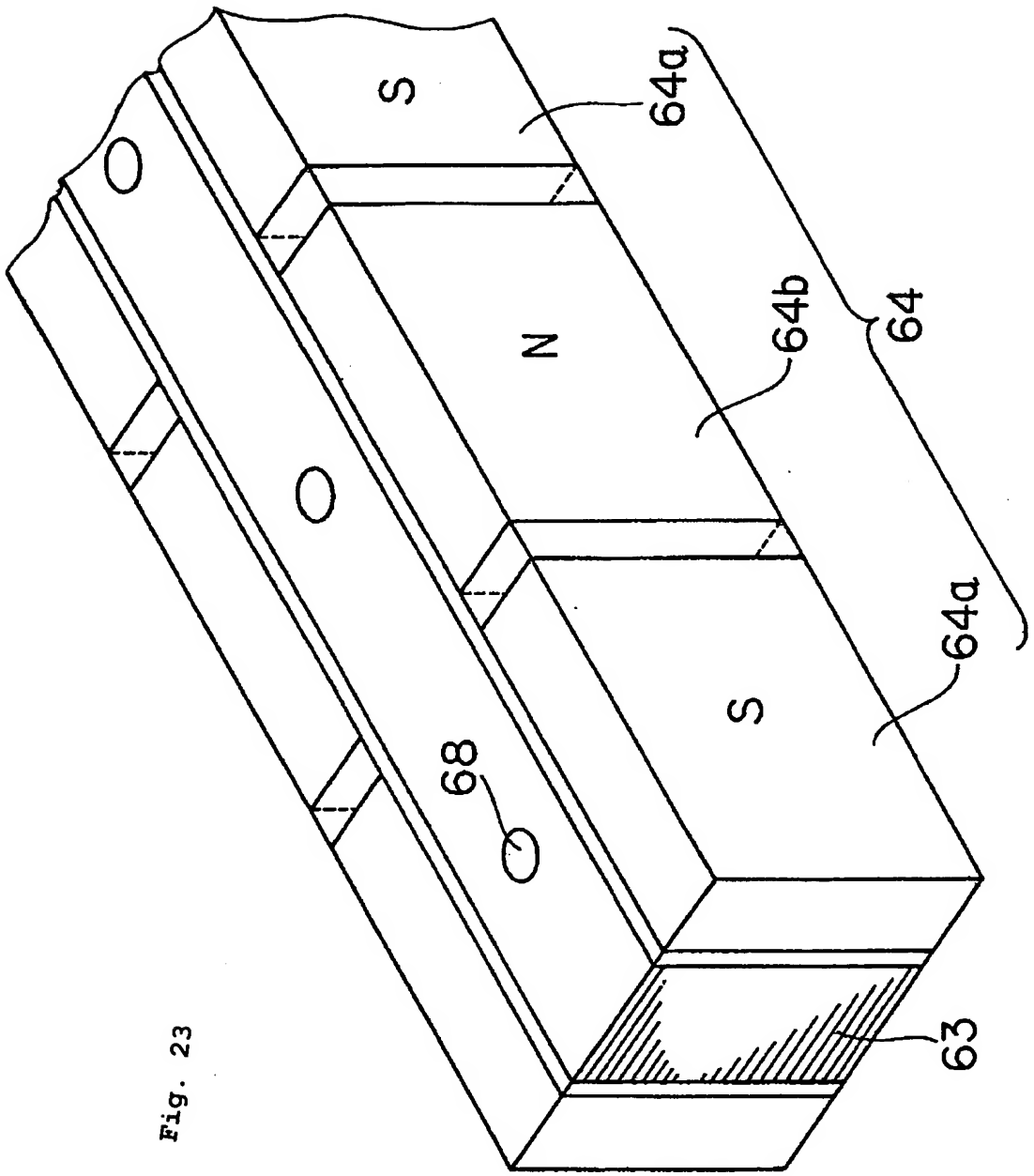


Fig. 23

Fig. 24

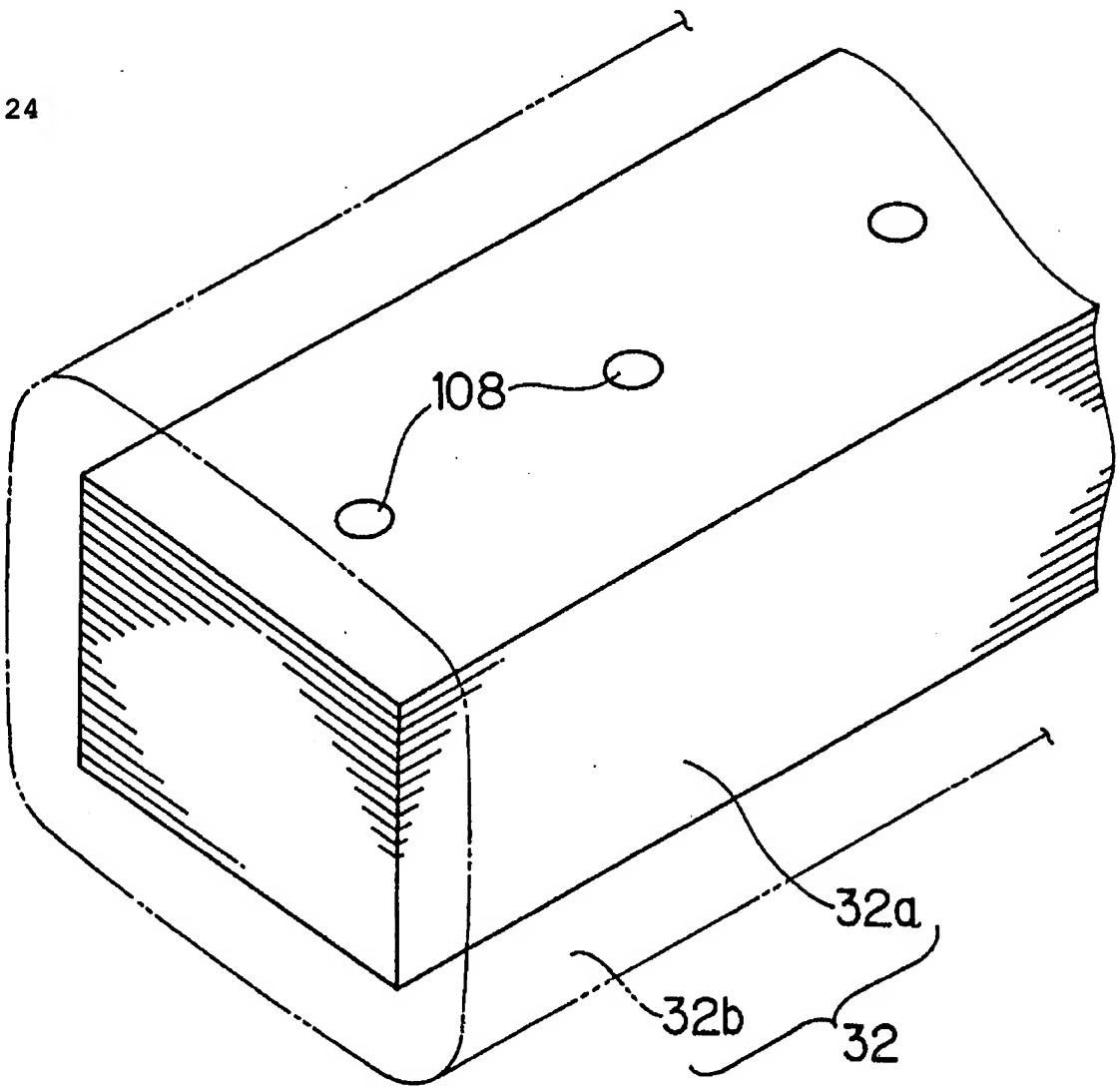


Fig. 25

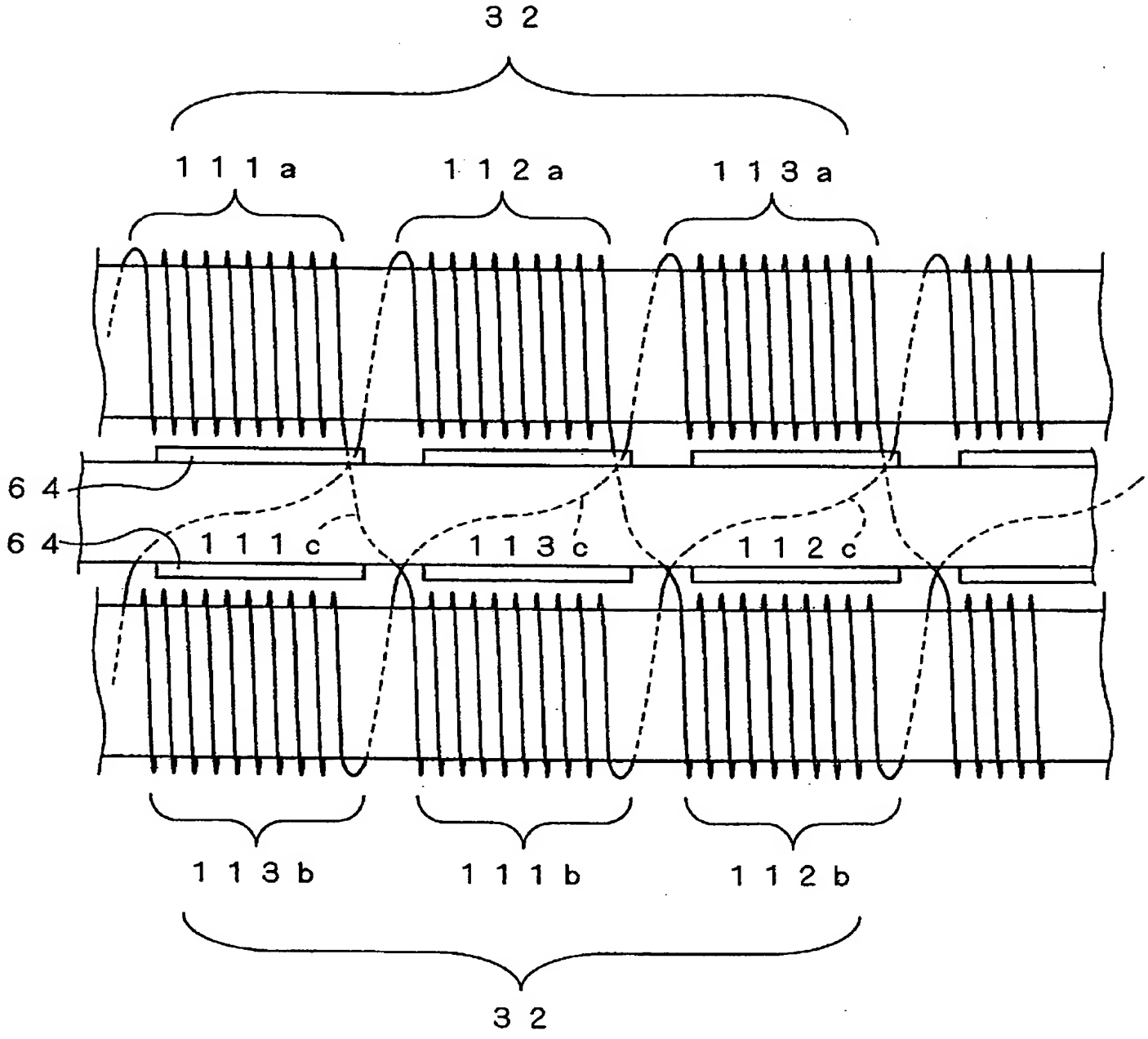
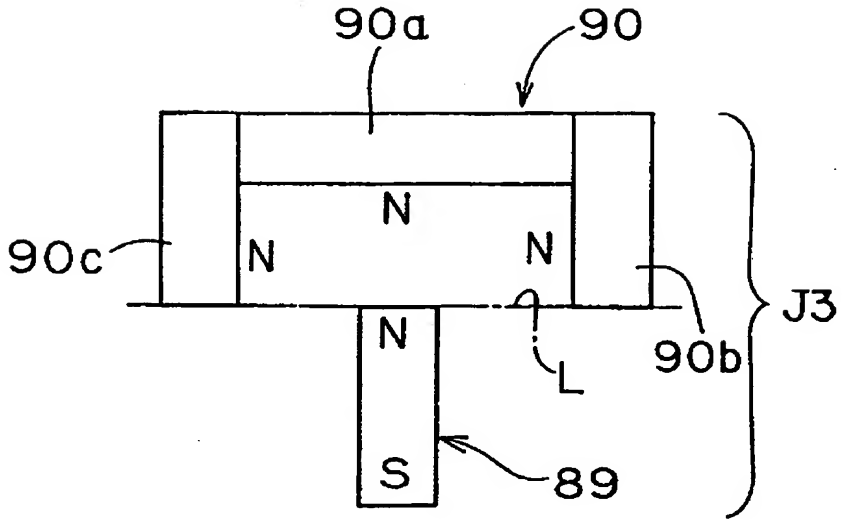
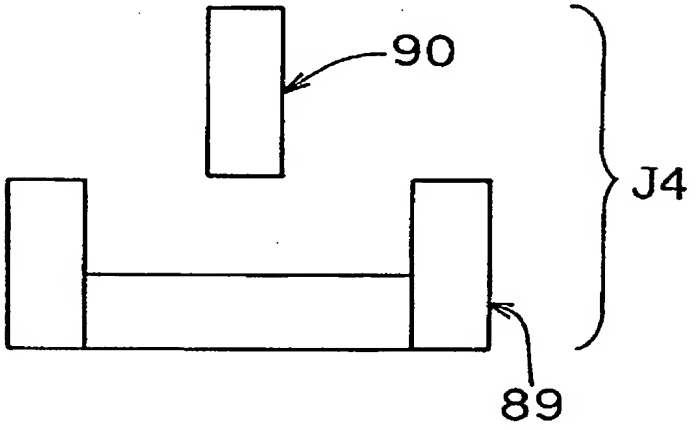


Fig. 26

(a)


90a
90
N
N
N
90c
N
90b
J3
L
S
89

(b)


90
J4
89

(c)

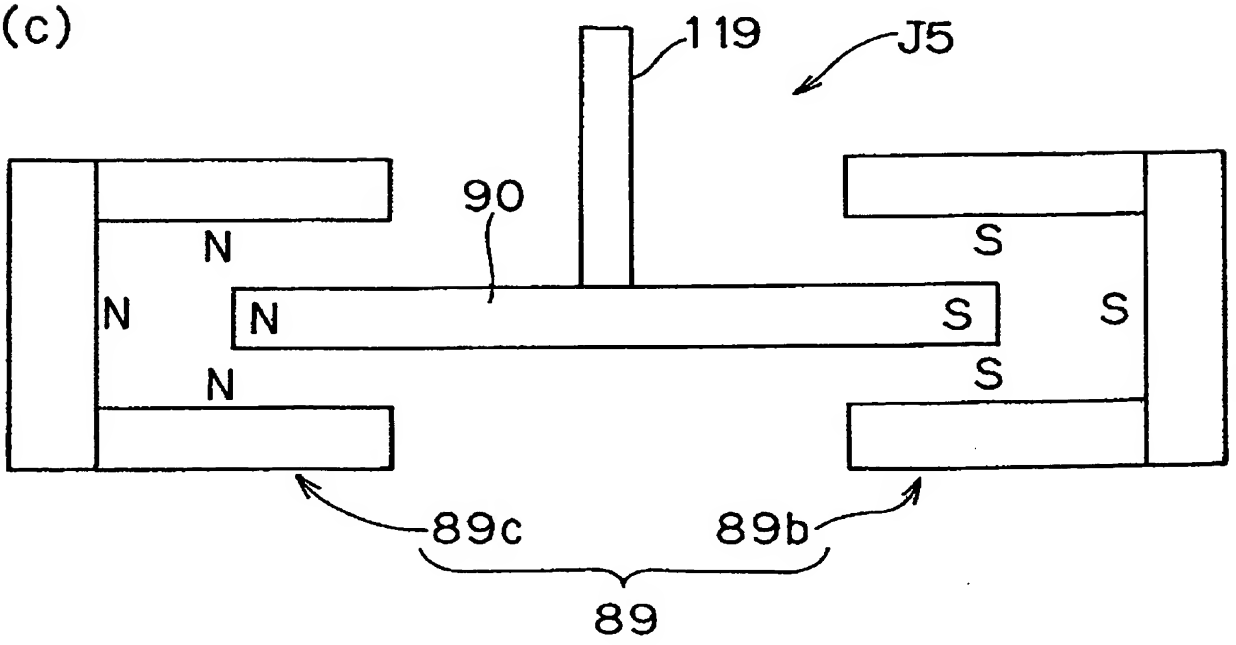
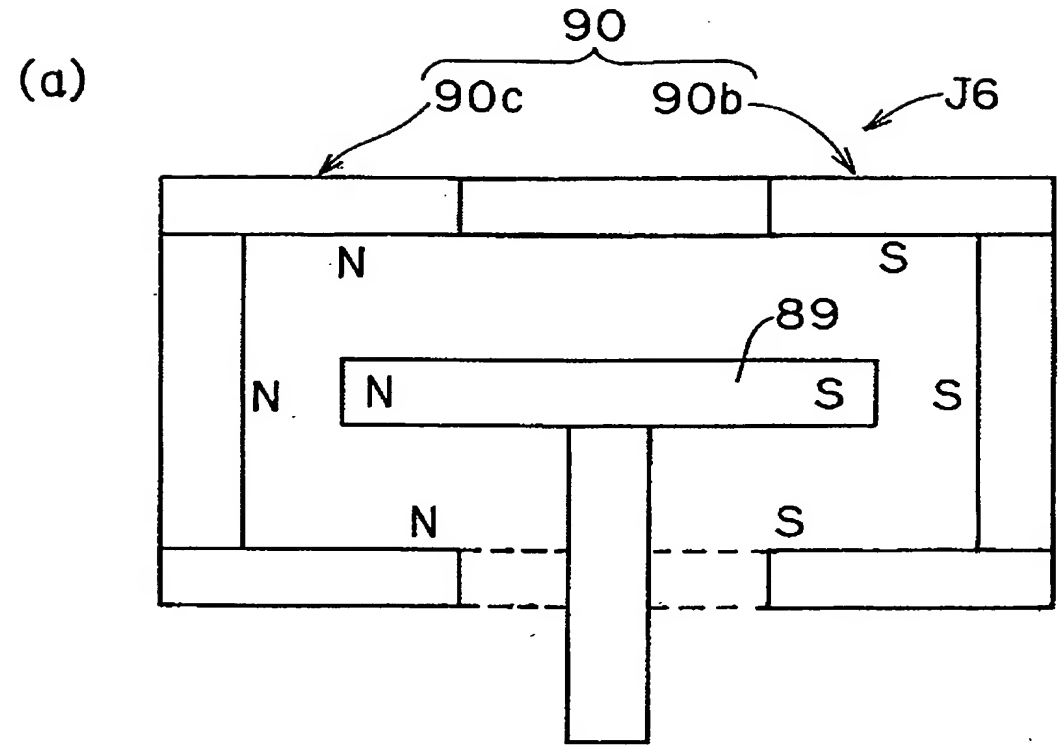
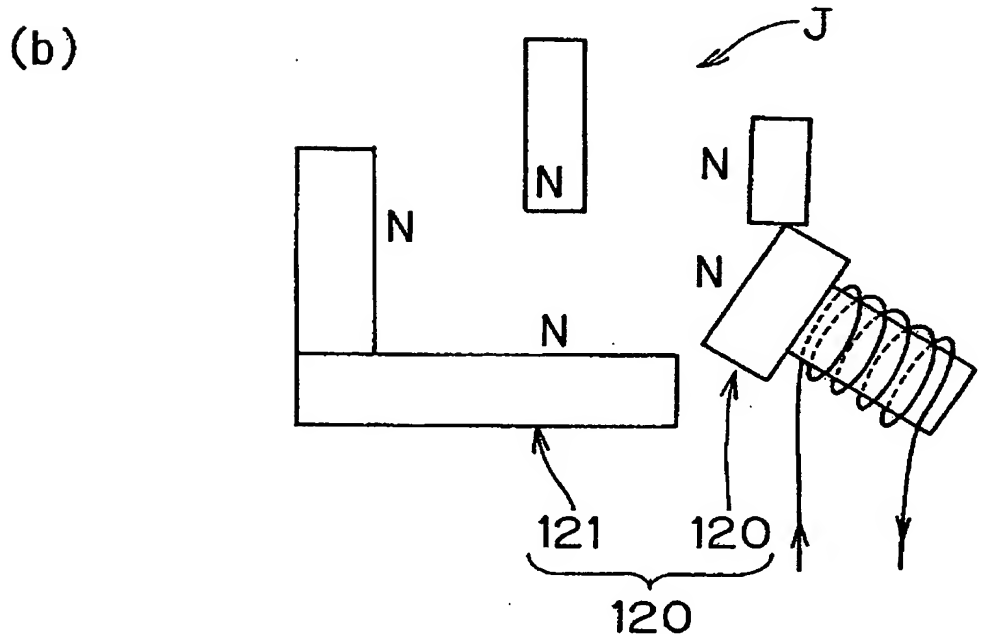

119
J5
90
N
S
N
N
S
S
N
S
89c
89b
89

Fig. 27





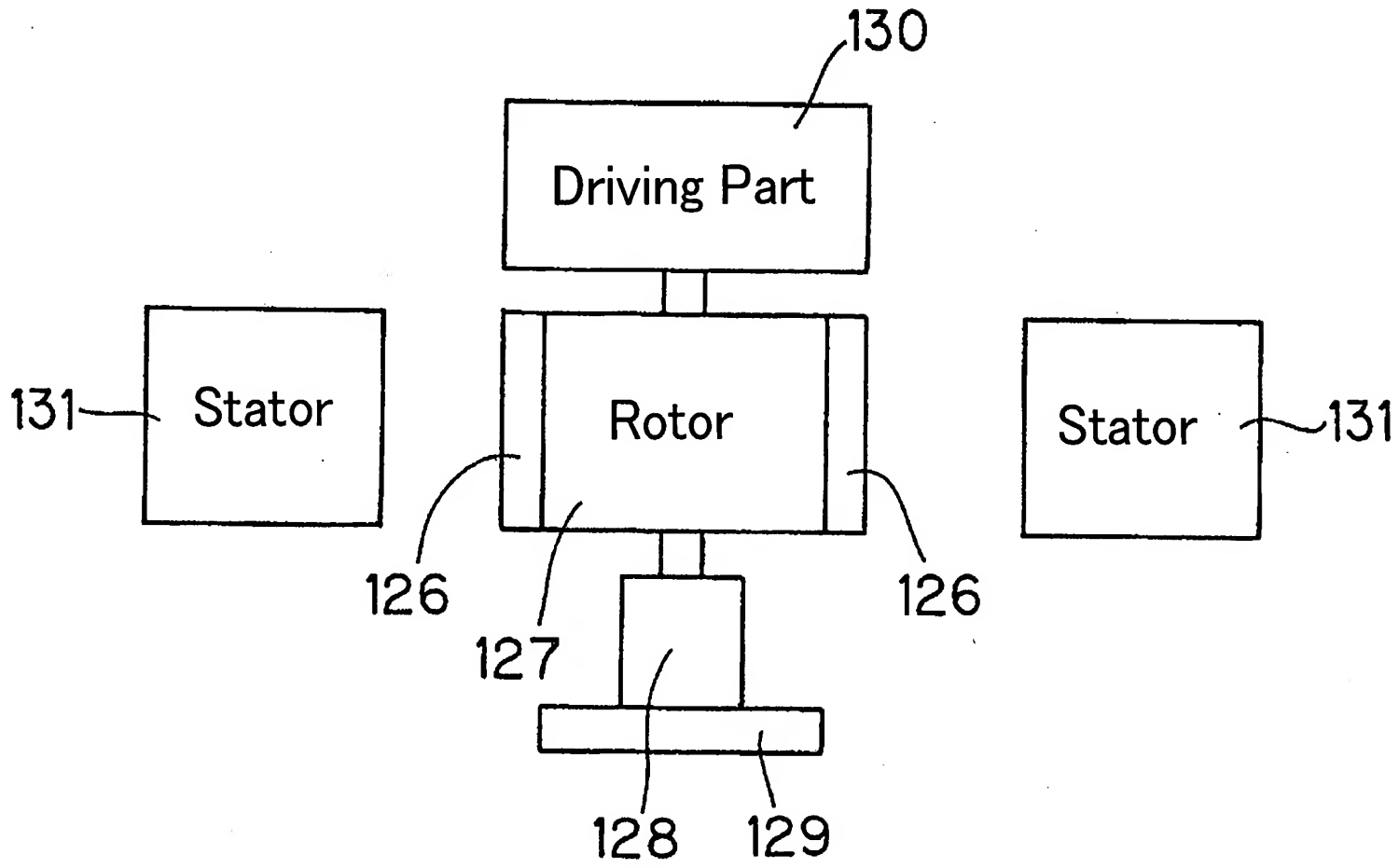

130
Driving Part
131
Stator
Rotor
Stator
131
126
127
126
128
129

Fig. 28

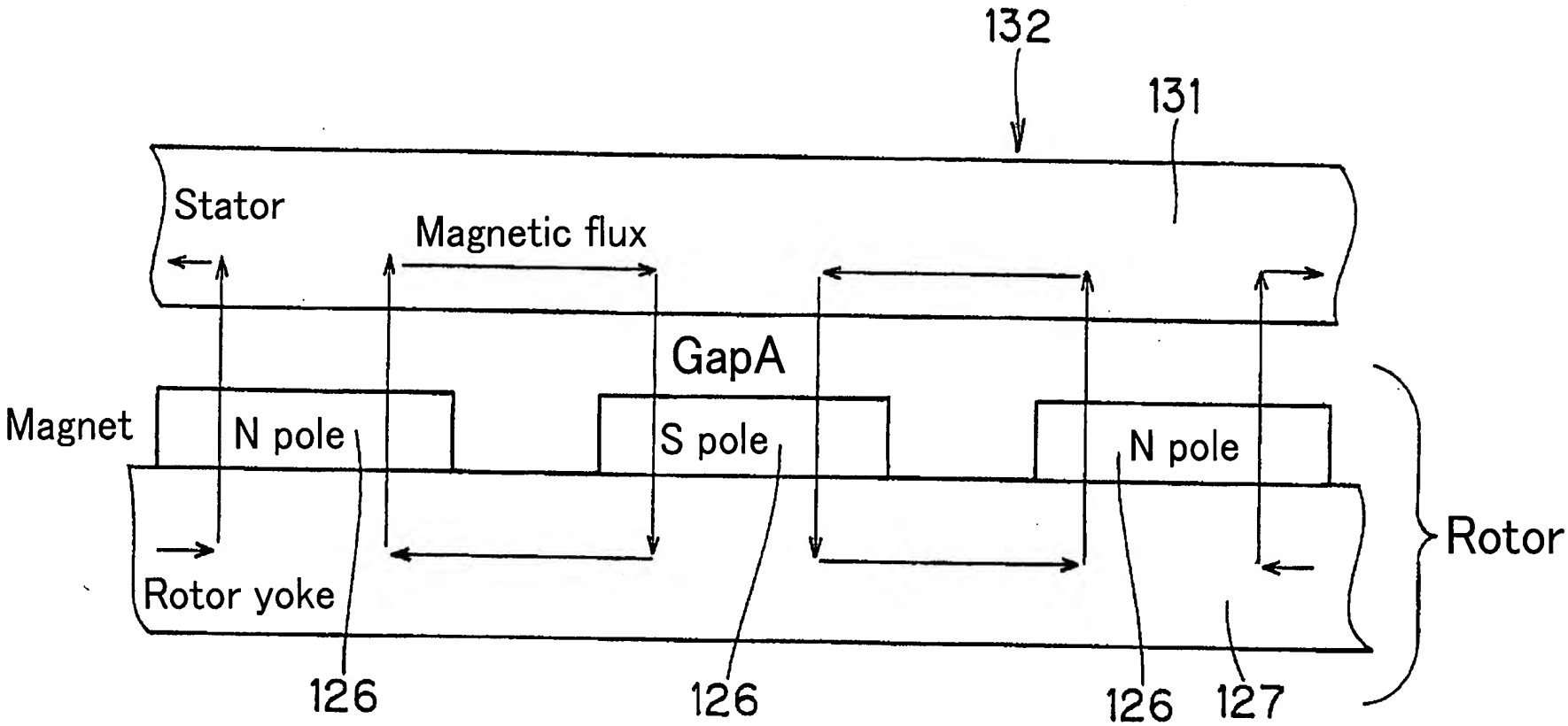

132
131
Stator
Magnetic flux
GapA
Magnet
N pole
S pole
N pole
Rotor
Rotor yoke
126
126
126
127

Fig. 29

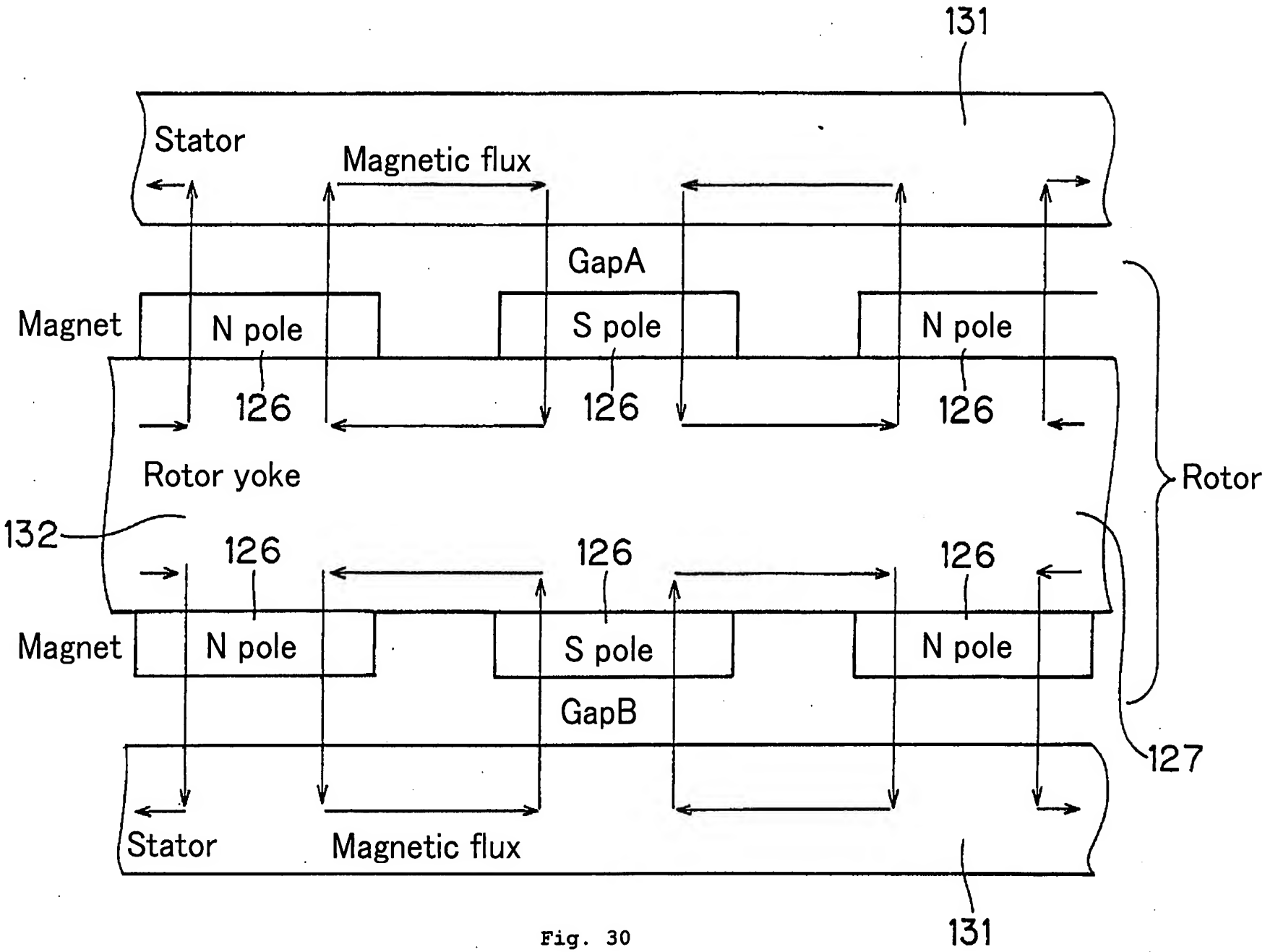

131
Stator
Magnetic flux
GapA
Magnet
N pole
S pole
N pole
126
126
126
Rotor yoke
Rotor
132
126
126
126
Magnet
N pole
S pole
N pole
GapB
127
Stator
Magnetic flux
131

Fig. 30

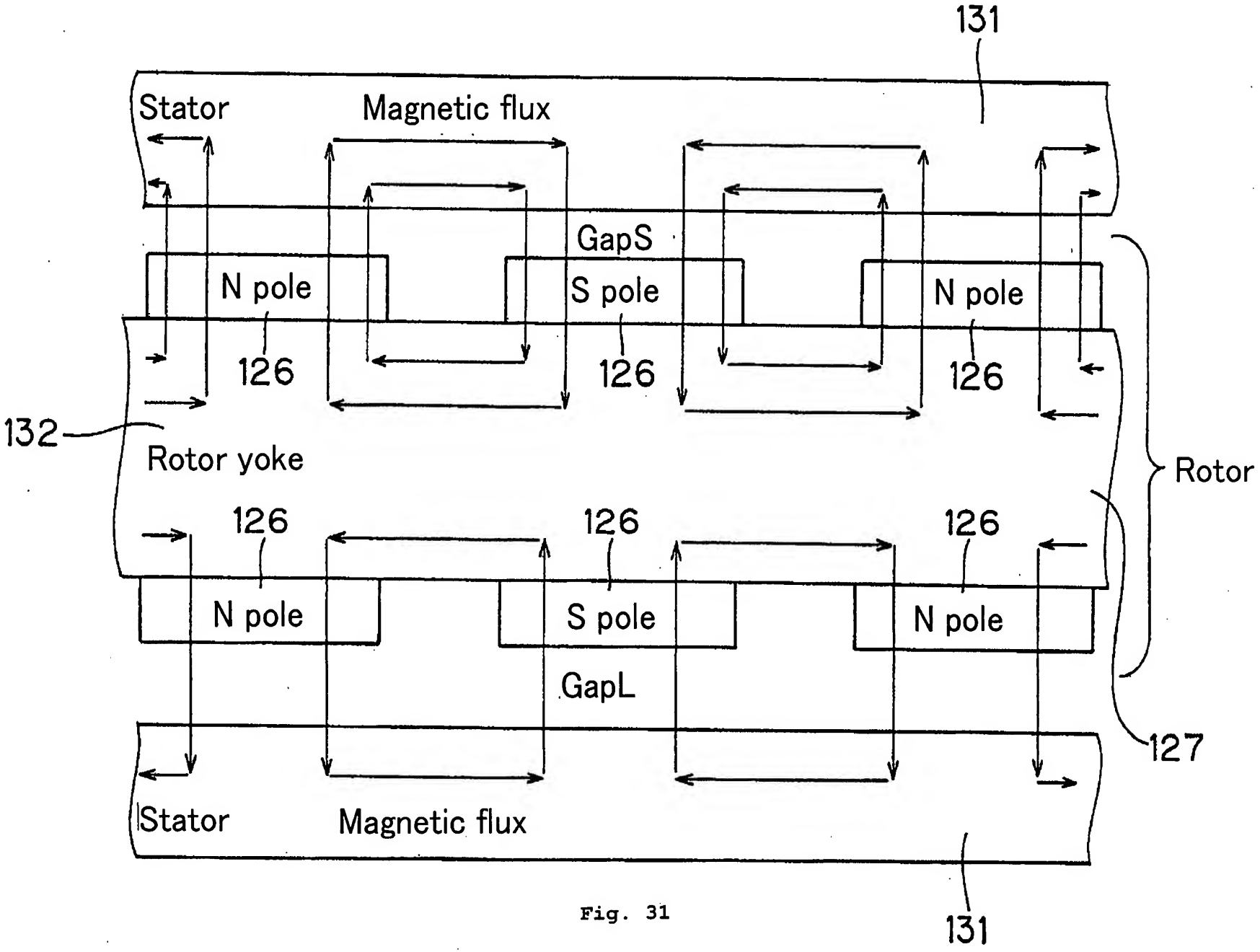

131
Stator
Magnetic flux
GapS
N pole
S pole
N pole
126
126
126
132
Rotor yoke
Rotor
126
126
126
N pole
S pole
N pole
GapL
127
Stator
Magnetic flux
131

Fig. 31

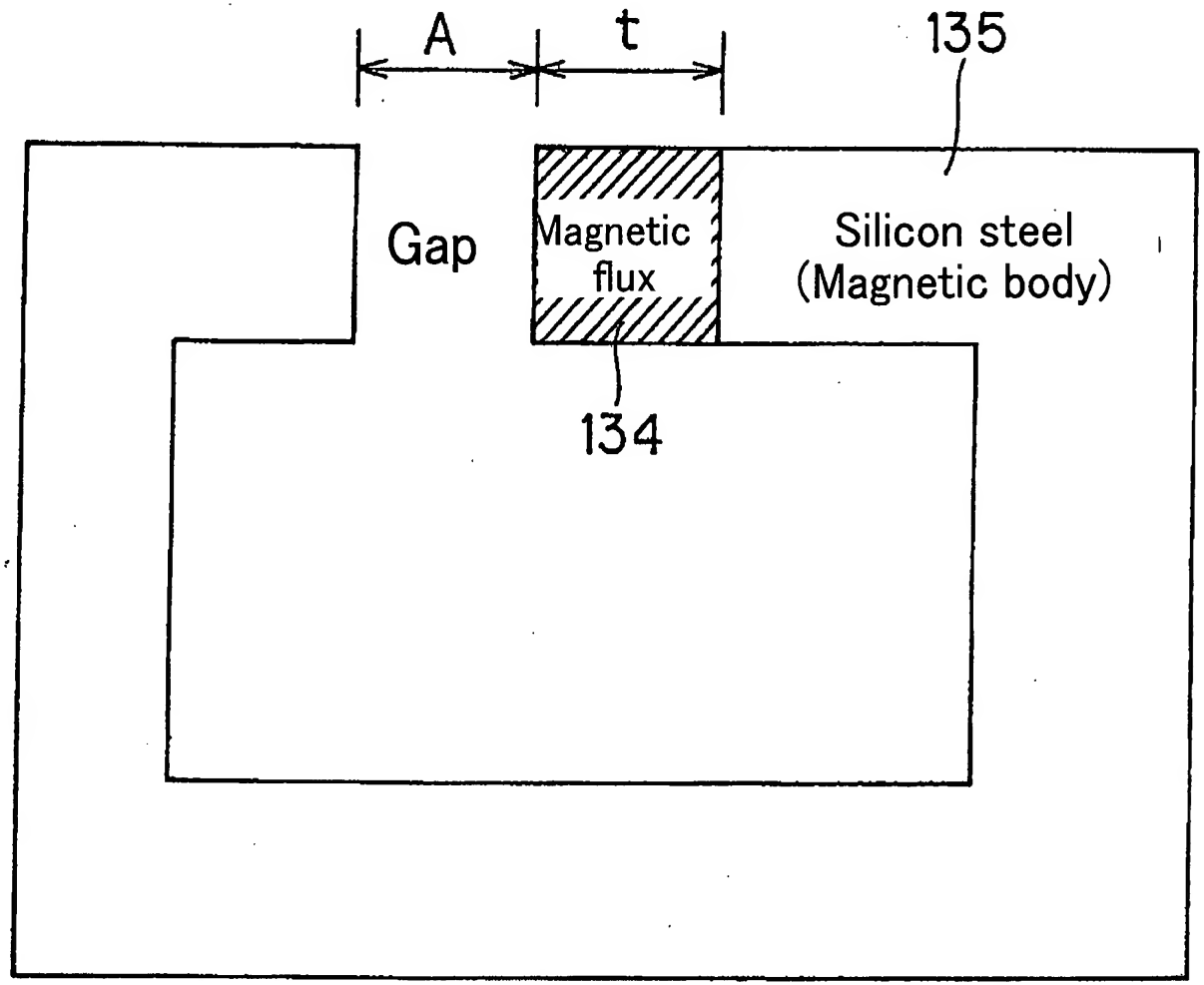


Fig. 32

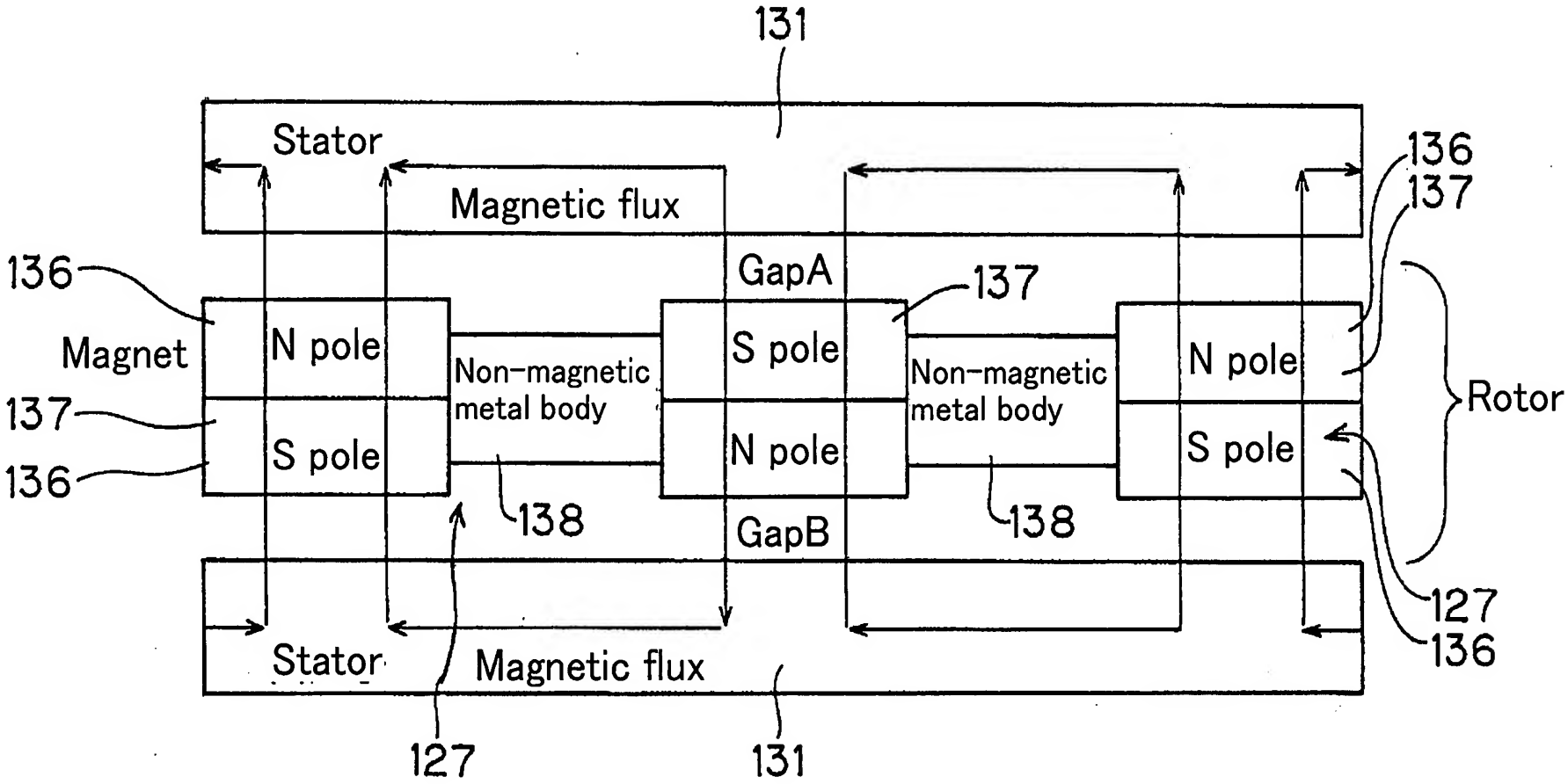

131
Stator
Magnetic flux
136
137
GapA
136
137
Magnet
N pole
Non-magnetic metal body
S pole
N pole
Non-magnetic metal body
N pole
Rotor
137
S pole
N pole
S pole
136
138
138
GapB
127
136
Stator
Magnetic flux
127
131

Fig. 33

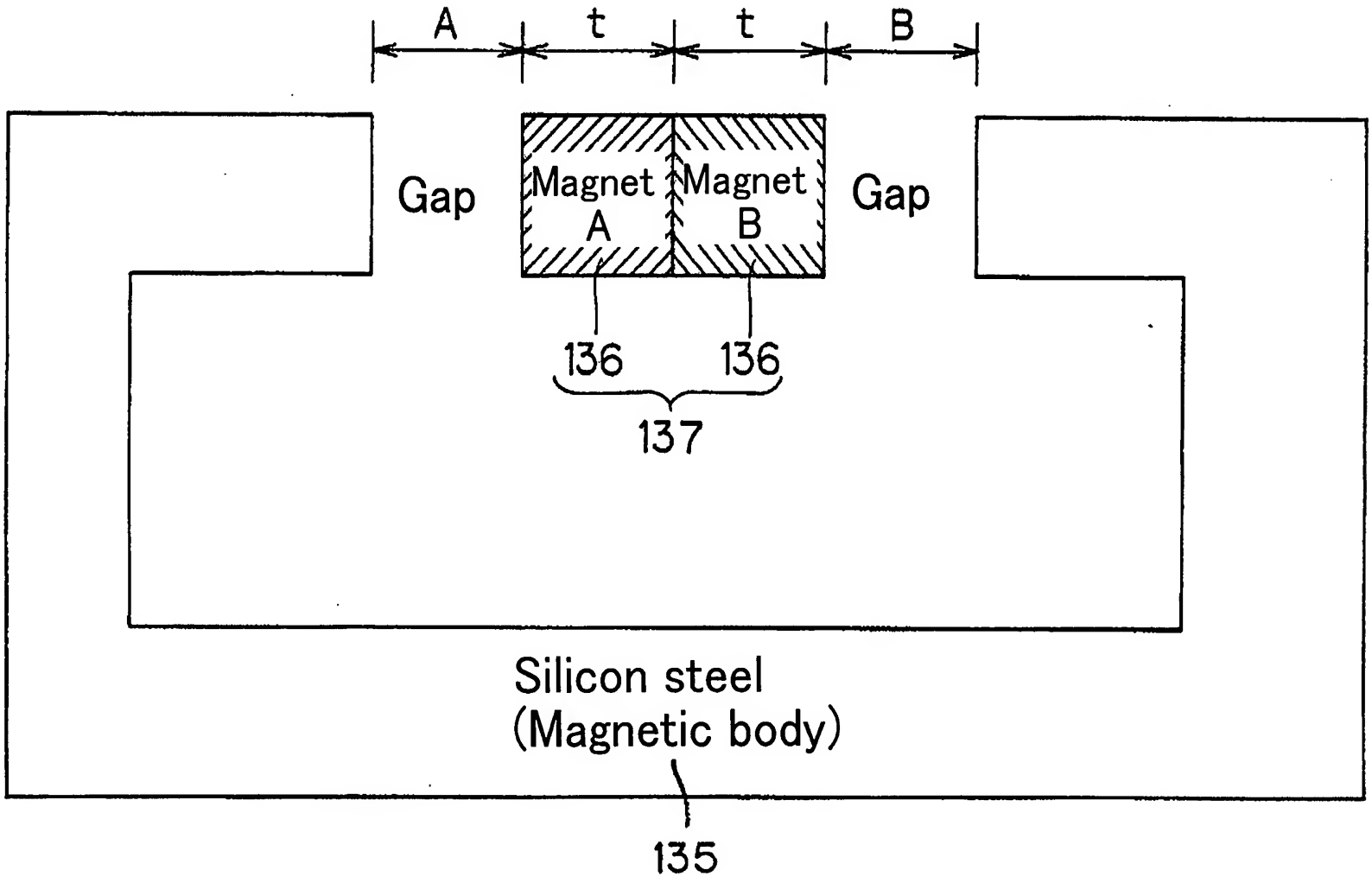

A
t
t
B
Gap
Magnet A
Magnet B
Gap
136
136
137
Silicon steel
(Magnetic body)
135

Fig. 34

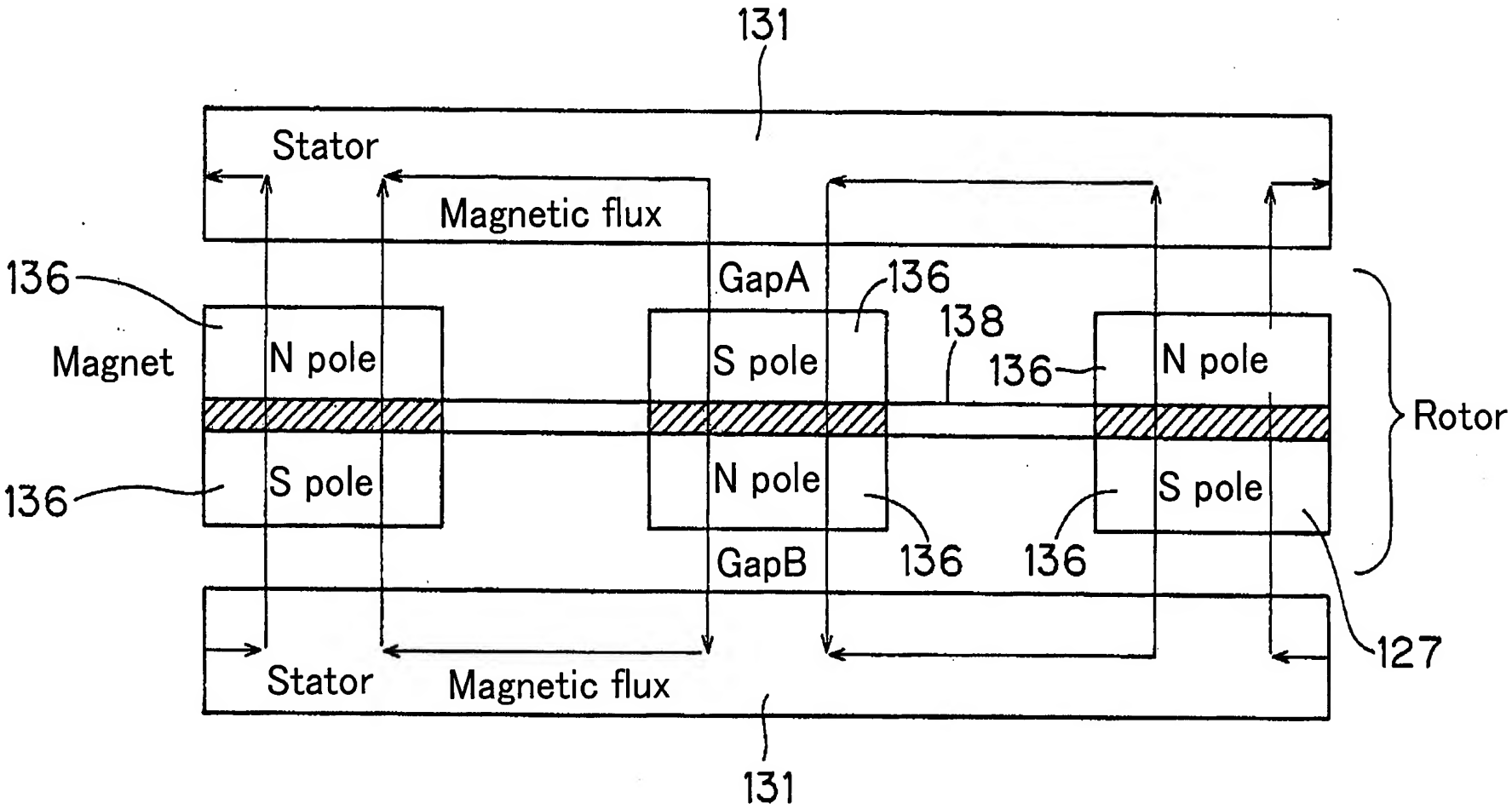

131
Stator
Magnetic flux
136
GapA
136
138
Magnet
N pole
S pole
136
N pole
Rotor
136
S pole
N pole
S pole
GapB
136
136
127
Stator
Magnetic flux
131

Fig. 35

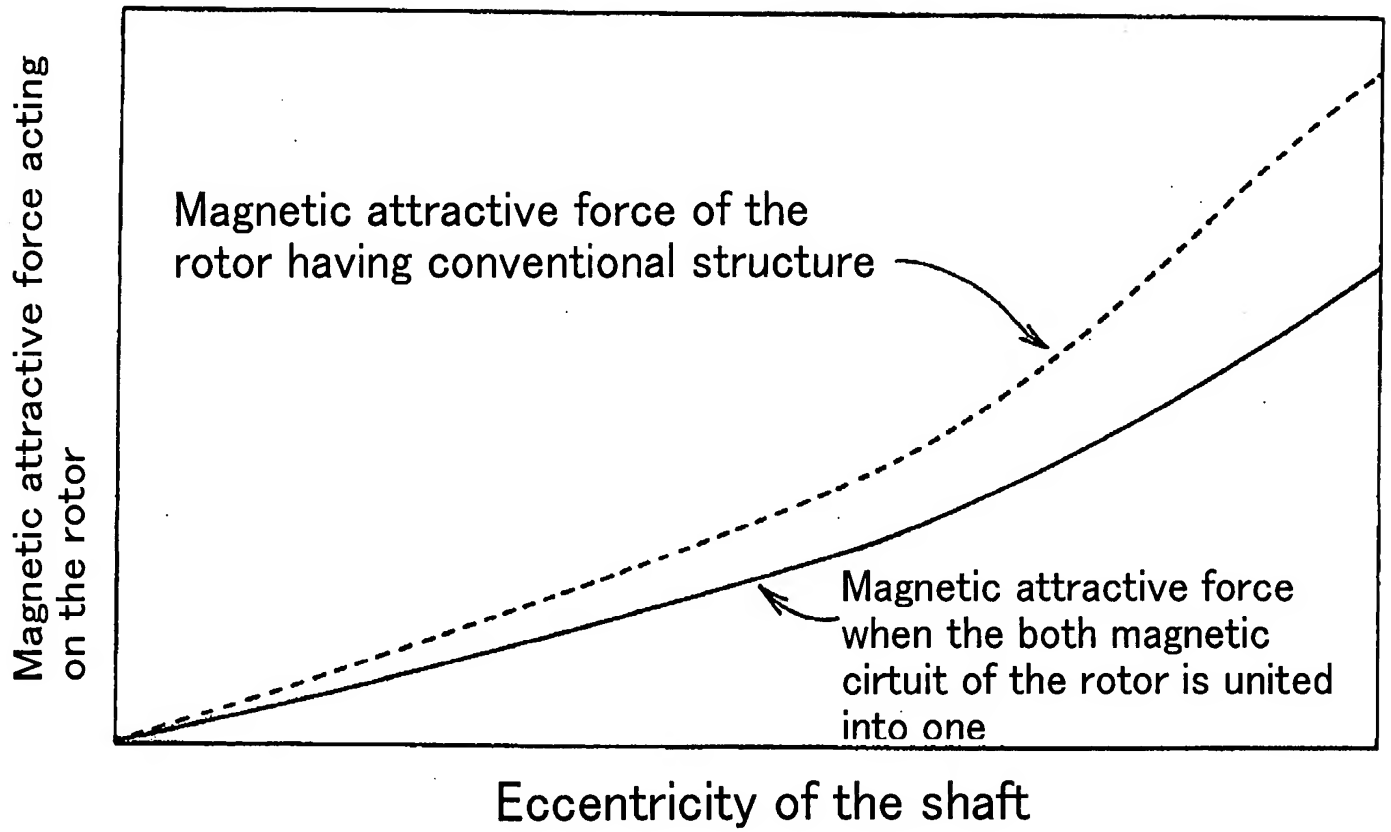

Magnetic attractive force acting on the rotor
Magnetic attractive force of the rotor having conventional structure
Magnetic attractive force when the both magnetic cirtuit of the rotor is united into one
Eccentricity of the shaft

Fig. 36

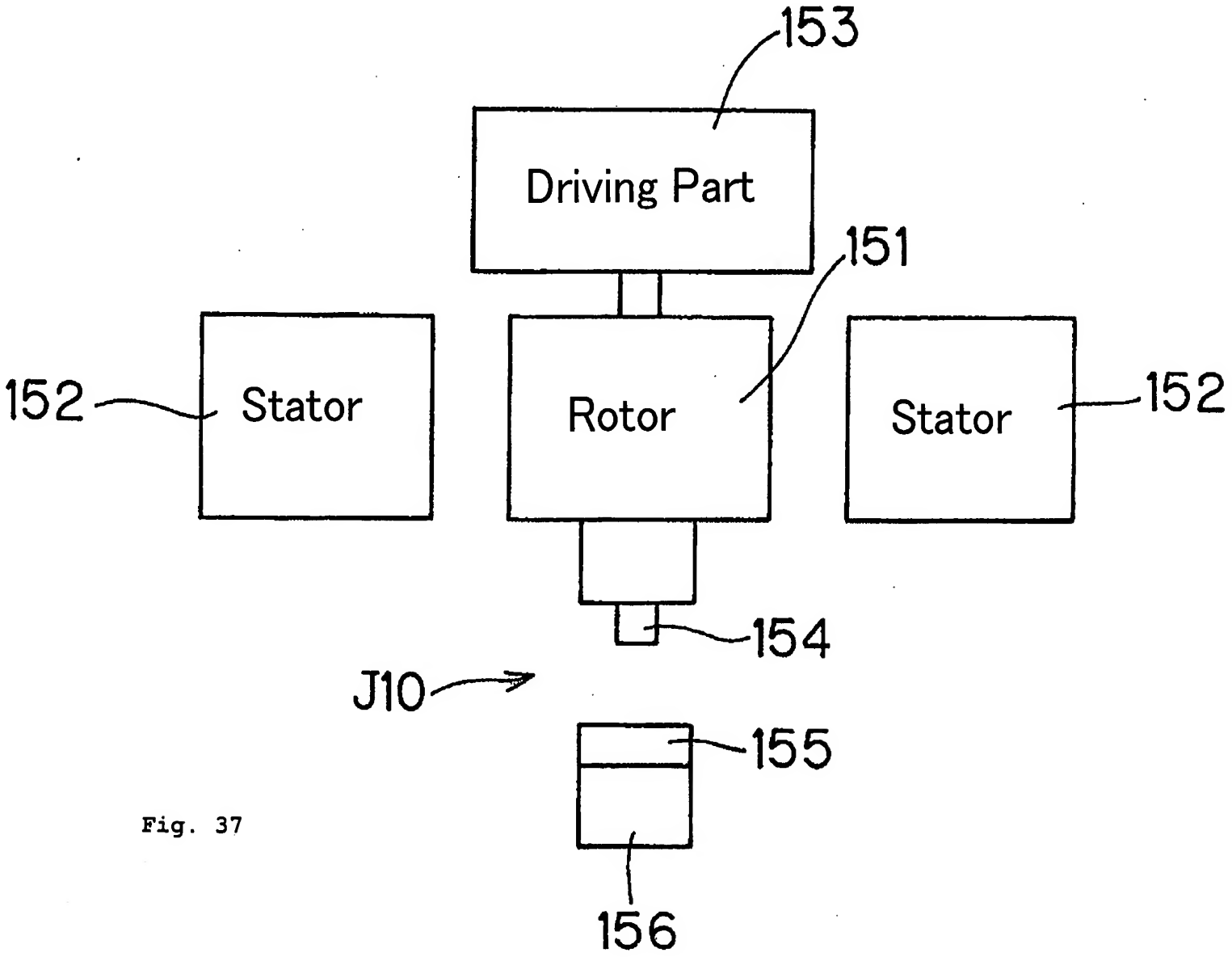
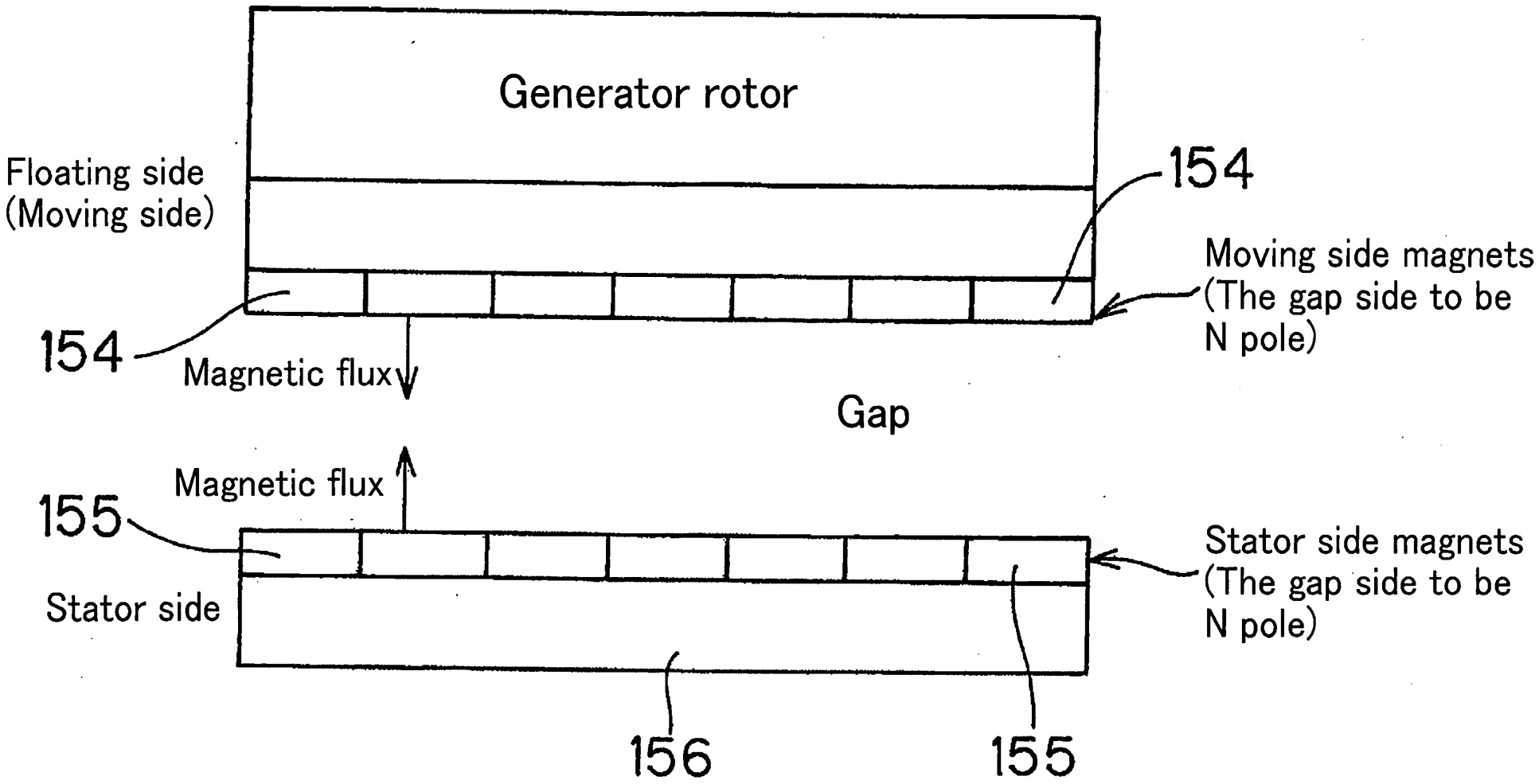

153
Driving Part
151
152
Stator
Rotor
Stator
152
154
J10
155
156

Fig. 37

Fig. 38


Generator rotor
Floating side
(Moving side)
154
Moving side magnets
(The gap side to be
N pole)
154
Magnetic flux
Gap
Magnetic flux
155
Stator side magnets
(The gap side to be
N pole)
Stator side
156
155

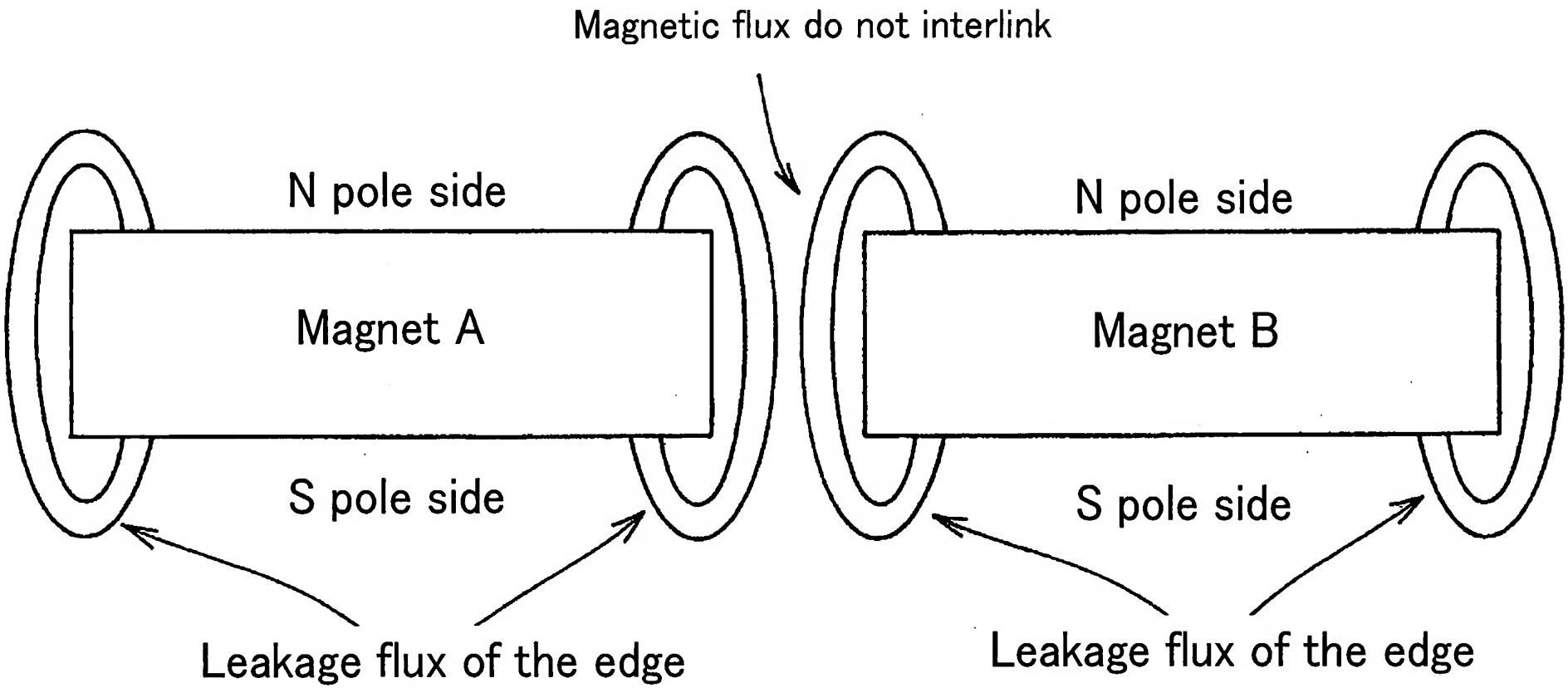

Magnetic flux do not interlink
N pole side
Magnet A
S pole side
N pole side
Magnet B
S pole side
Leakage flux of the edge
Leakage flux of the edge

Fig. 39

Fig. 40

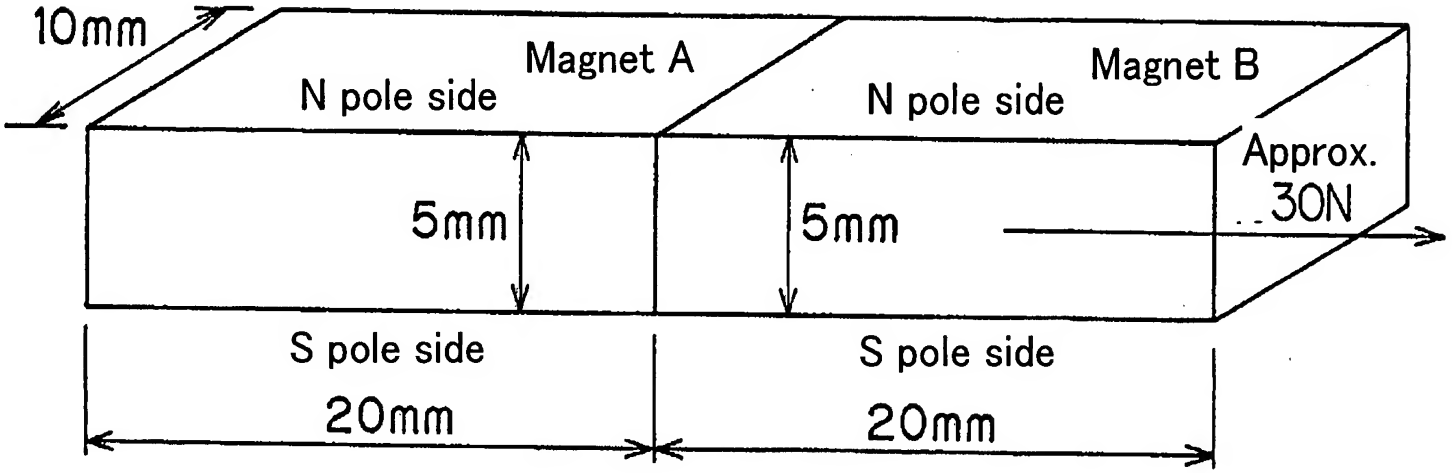

10mm
Magnet A
N pole side
Magnet B
N pole side
Approx.
30N
5mm
5mm
S pole side
S pole side
20mm
20mm

Fig. 41

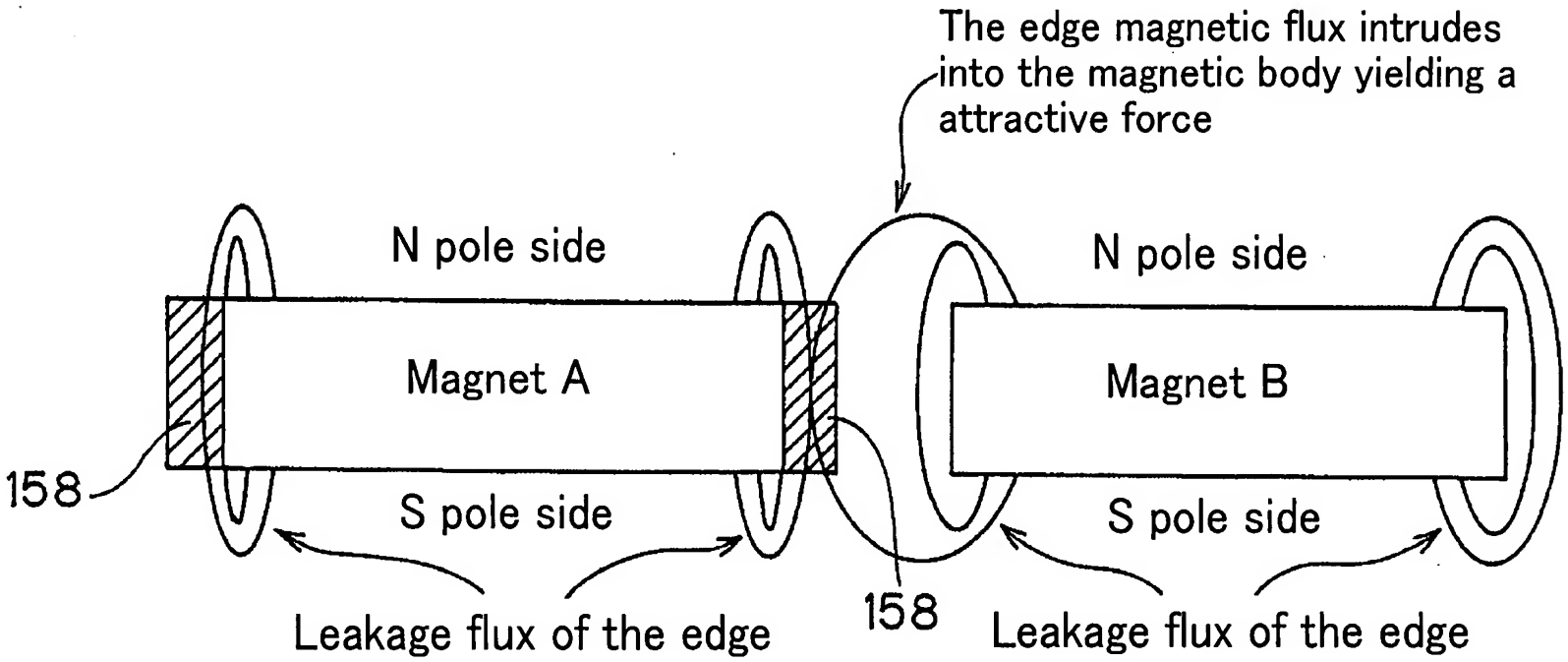

The edge magnetic flux intrudes into the magnetic body yielding a attractive force
N pole side
N pole side
Magnet A
Magnet B
158
S pole side
S pole side
158
Leakage flux of the edge
Leakage flux of the edge

Fig. 42

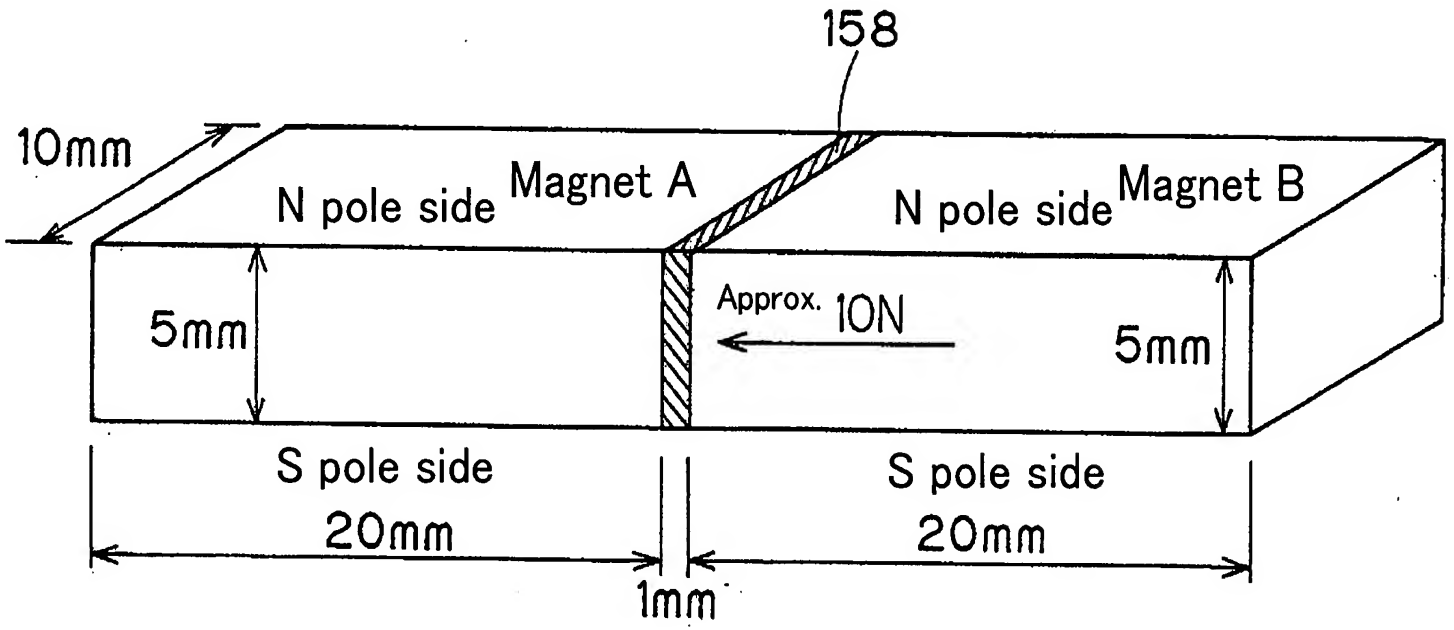

158
10mm
N pole side
Magnet A
N pole side
Magnet B
5mm
Approx. 10N
5mm
S pole side
20mm
S pole side
20mm
1mm

Fig. 43

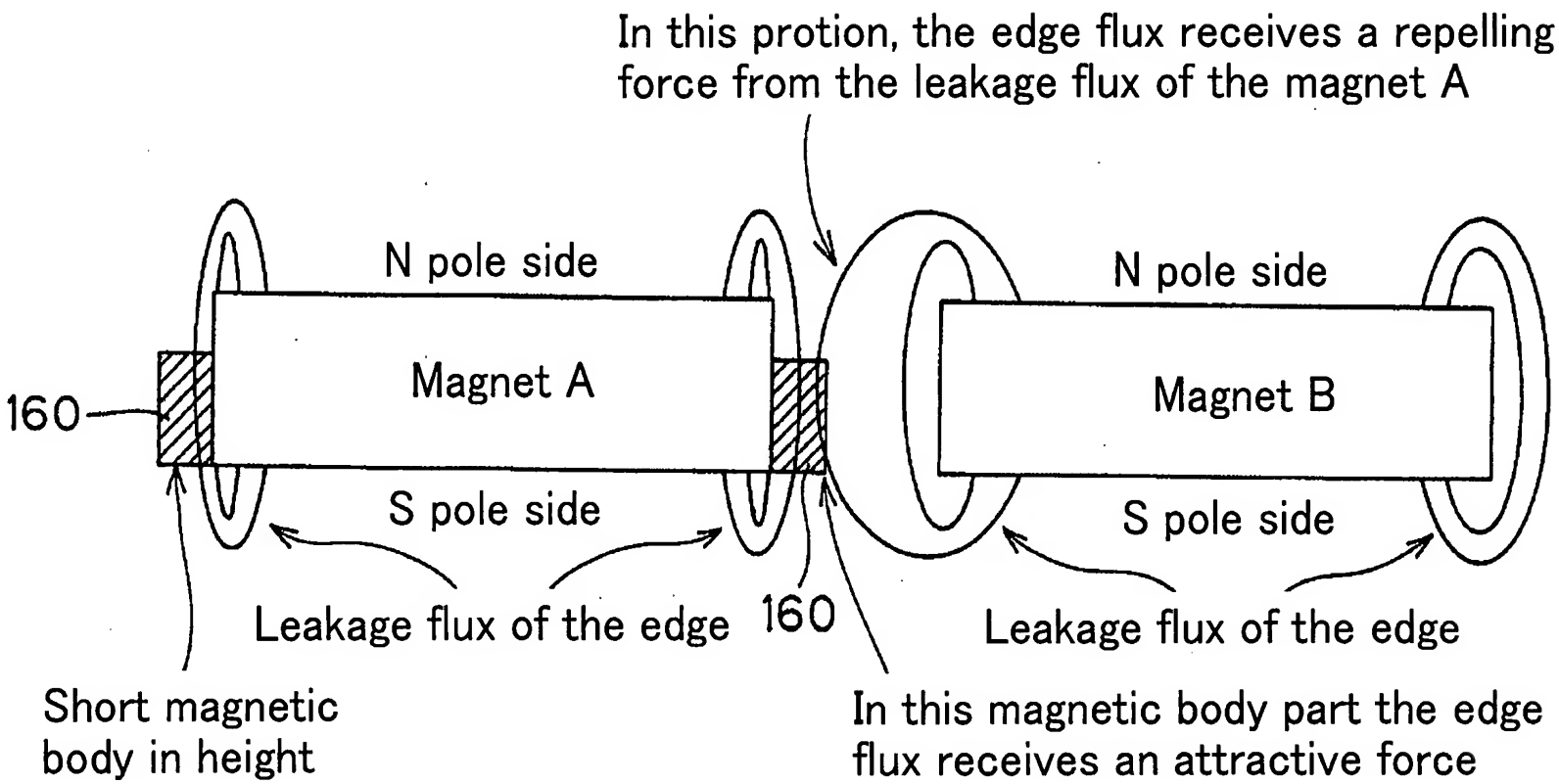
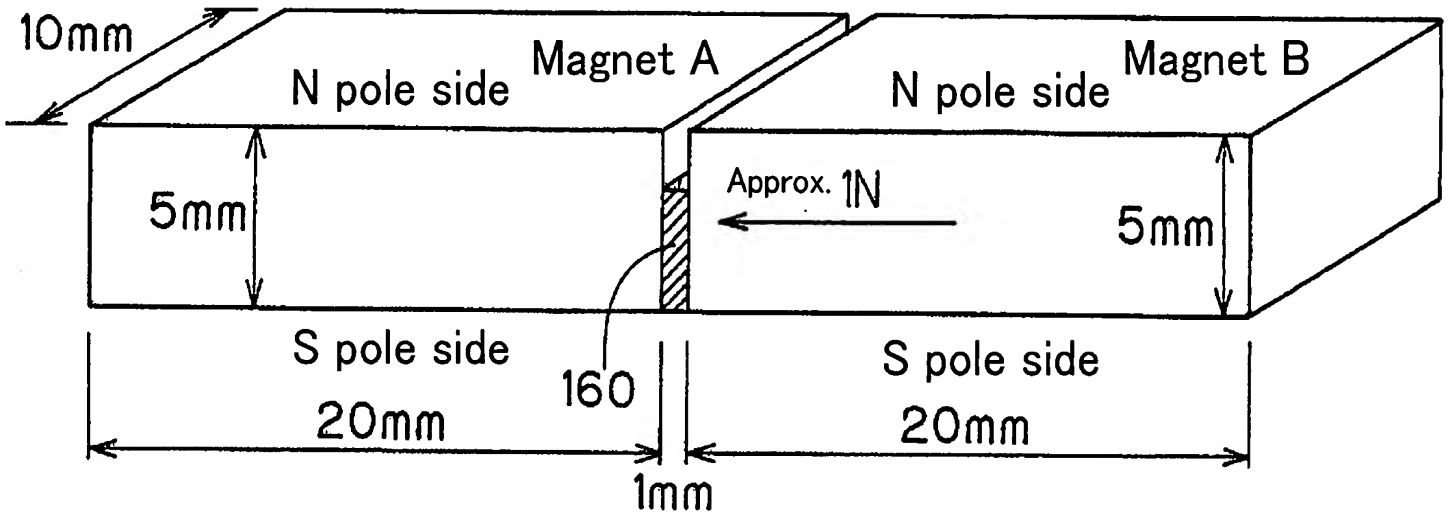

In this protion, the edge flux receives a repelling force from the leakage flux of the magnet A
N pole side
Magnet A
S pole side
160
Leakage flux of the edge
Short magnetic body in height
160
N pole side
Magnet B
S pole side
Leakage flux of the edge
In this magnetic body part the edge flux receives an attractive force

Fig. 44


10mm
Magnet A
N pole side
Magnet B
N pole side
5mm
Approx. 1N
5mm
S pole side
160
S pole side
20mm
20mm
1mm

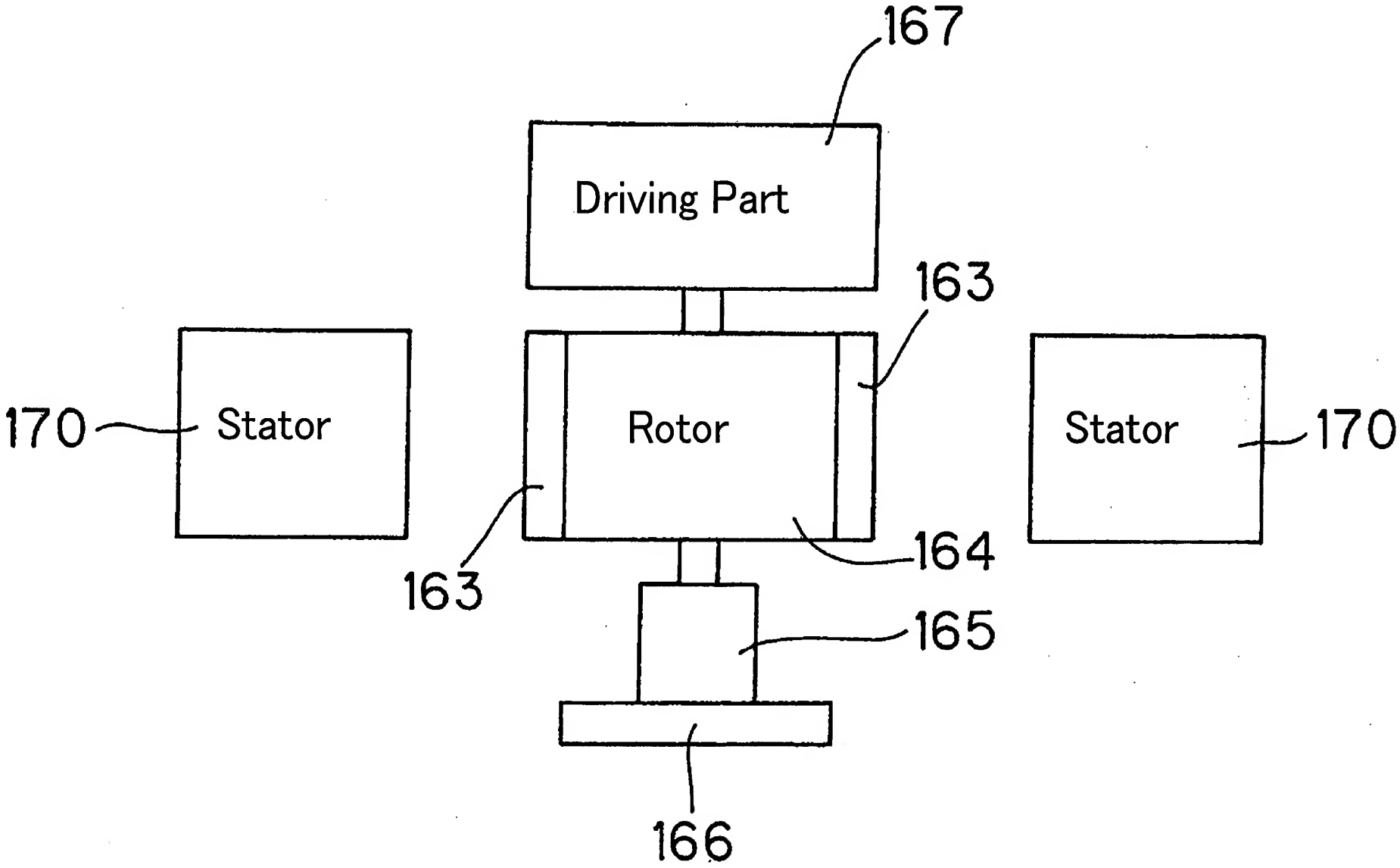

167
Driving Part
163
170
Stator
Rotor
Stator
170
163
164
165
166

Fig. 45

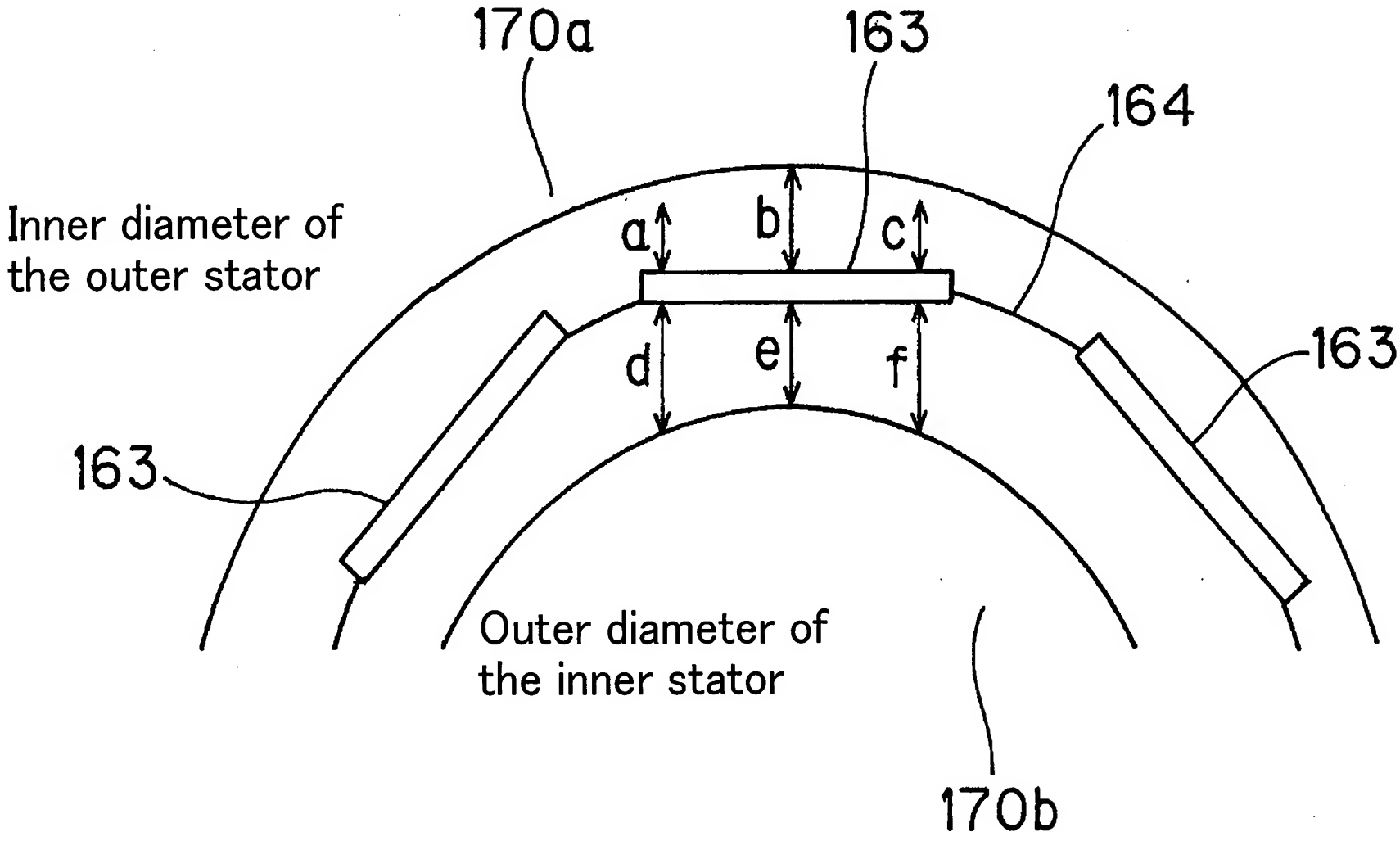
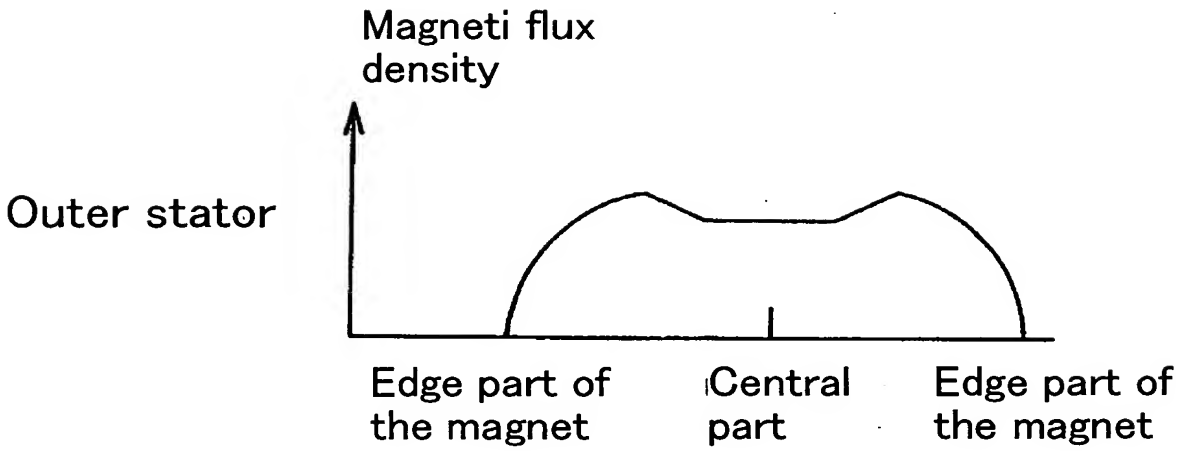

170a
163
164
Inner diameter of
the outer stator
a
b
c
d
e
f
163
163
Outer diameter of
the inner stator
170b

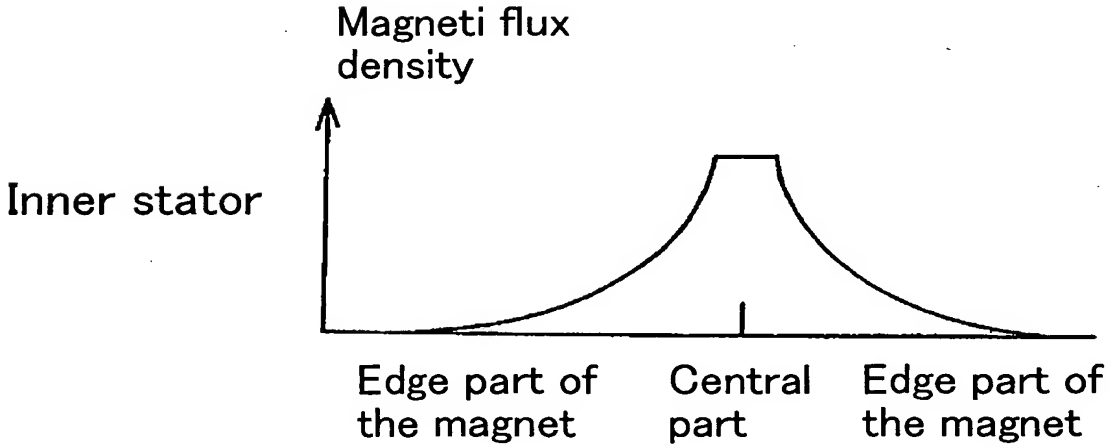
Fig. 46

Fig. 47

(a)


Magneti flux density
Outer stator
Edge part of the magnet
Central part
Edge part of the magnet

(b)


Magneti flux density
Inner stator
Edge part of the magnet
Central part
Edge part of the magnet

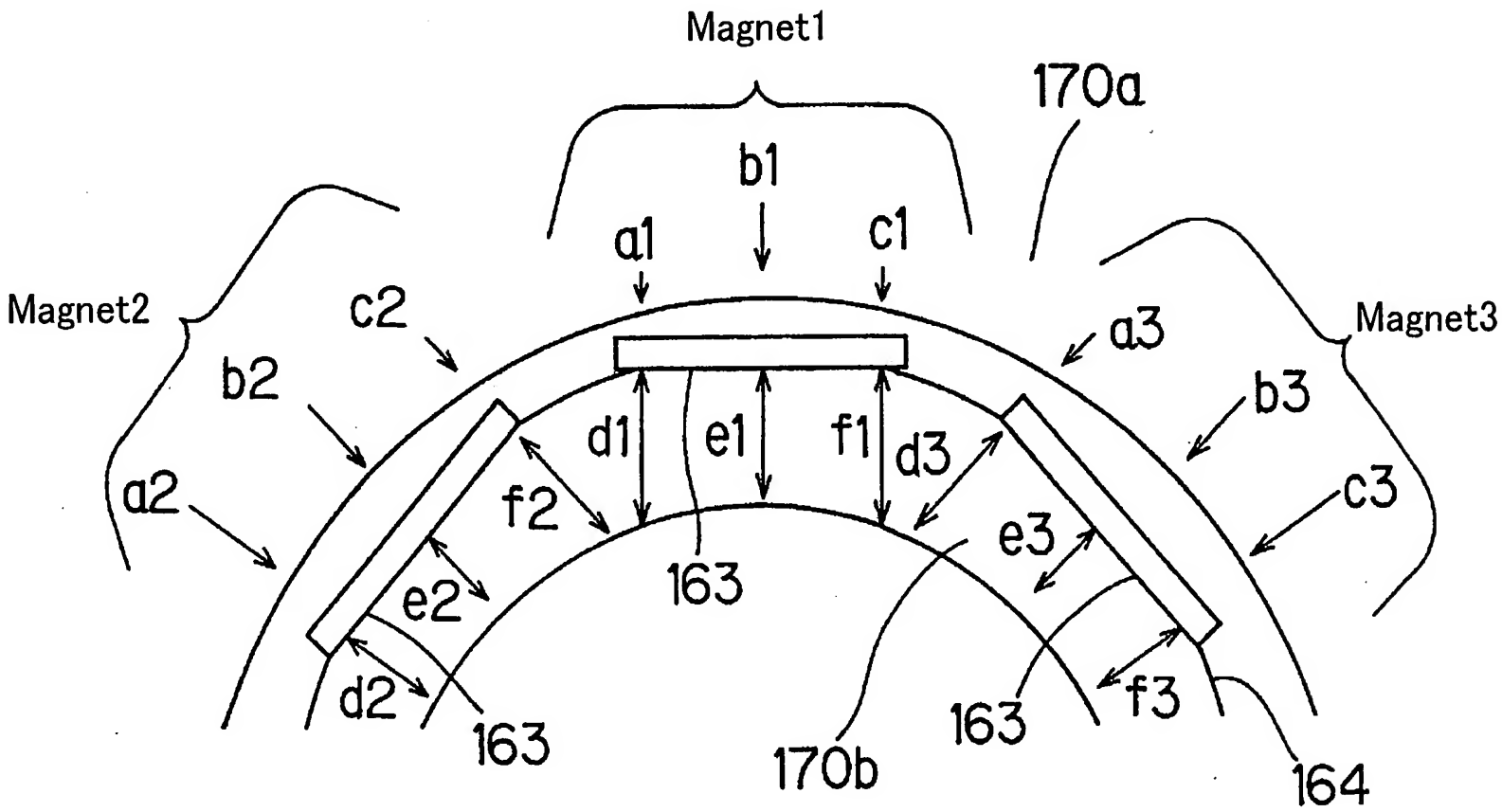

Magnet1
170a
b1
a1
c1
Magnet2
c2
a3
Magnet3
b2
b3
d1
e1
f1
d3
a2
f2
c3
e3
e2
163
d2
163
163
f3
170b
164

Fig. 48

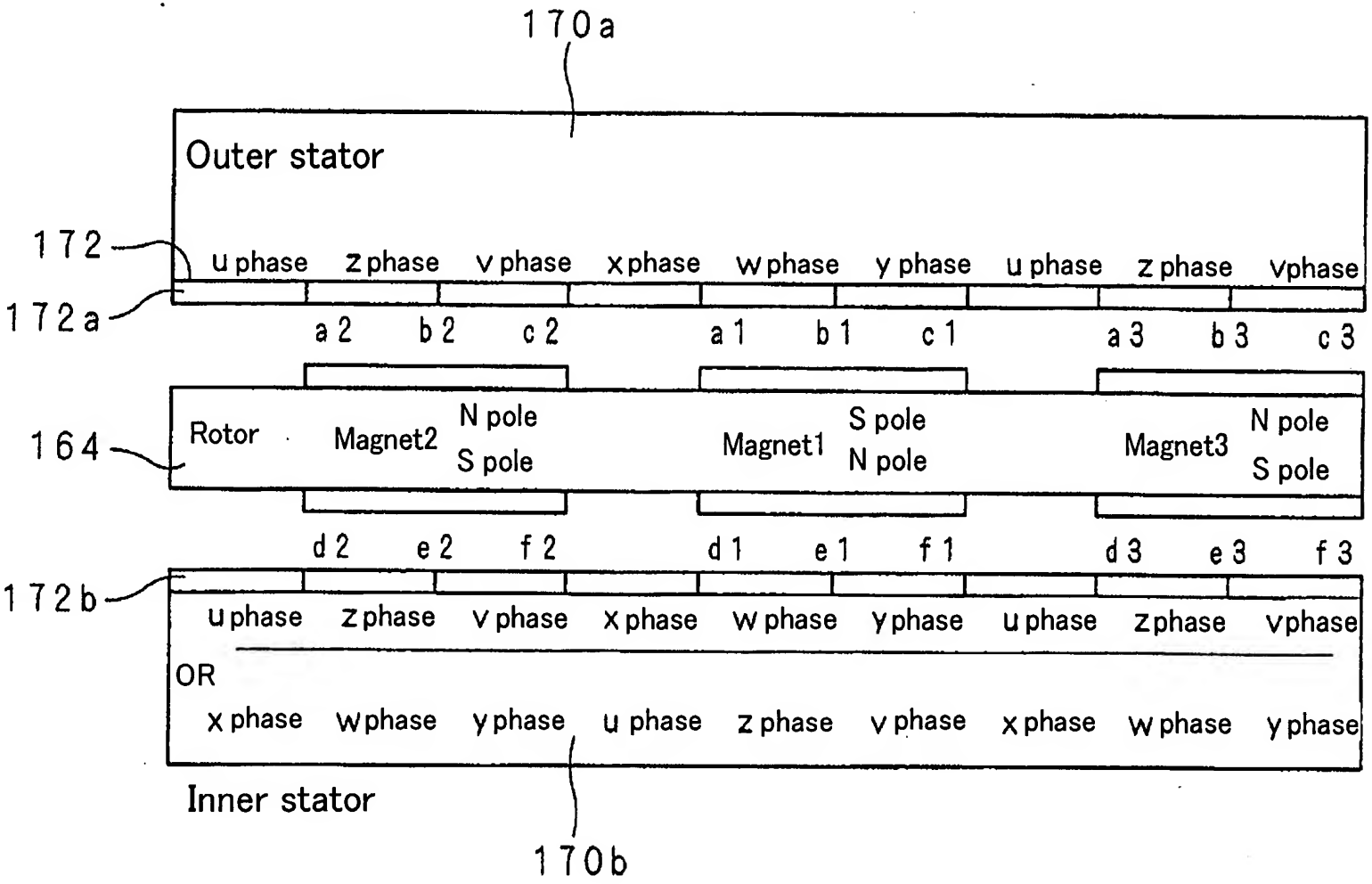

170a
Outer stator
172
172a
u phase
z phase
v phase
x phase
w phase
y phase
u phase
z phase
vphase
a 2
b 2
c 2
a 1
b 1
c 1
a 3
b 3
c 3
164
Rotor
Magnet2
N pole
S pole
Magnet1
S pole
N pole
Magnet3
N pole
S pole
d 2
e 2
f 2
d 1
e 1
f 1
d 3
e 3
f 3
172b
u phase
z phase
v phase
x phase
w phase
y phase
u phase
z phase
vphase
OR
x phase
w phase
y phase
u phase
z phase
v phase
x phase
w phase
y phase
Inner stator
170b

Fig. 49

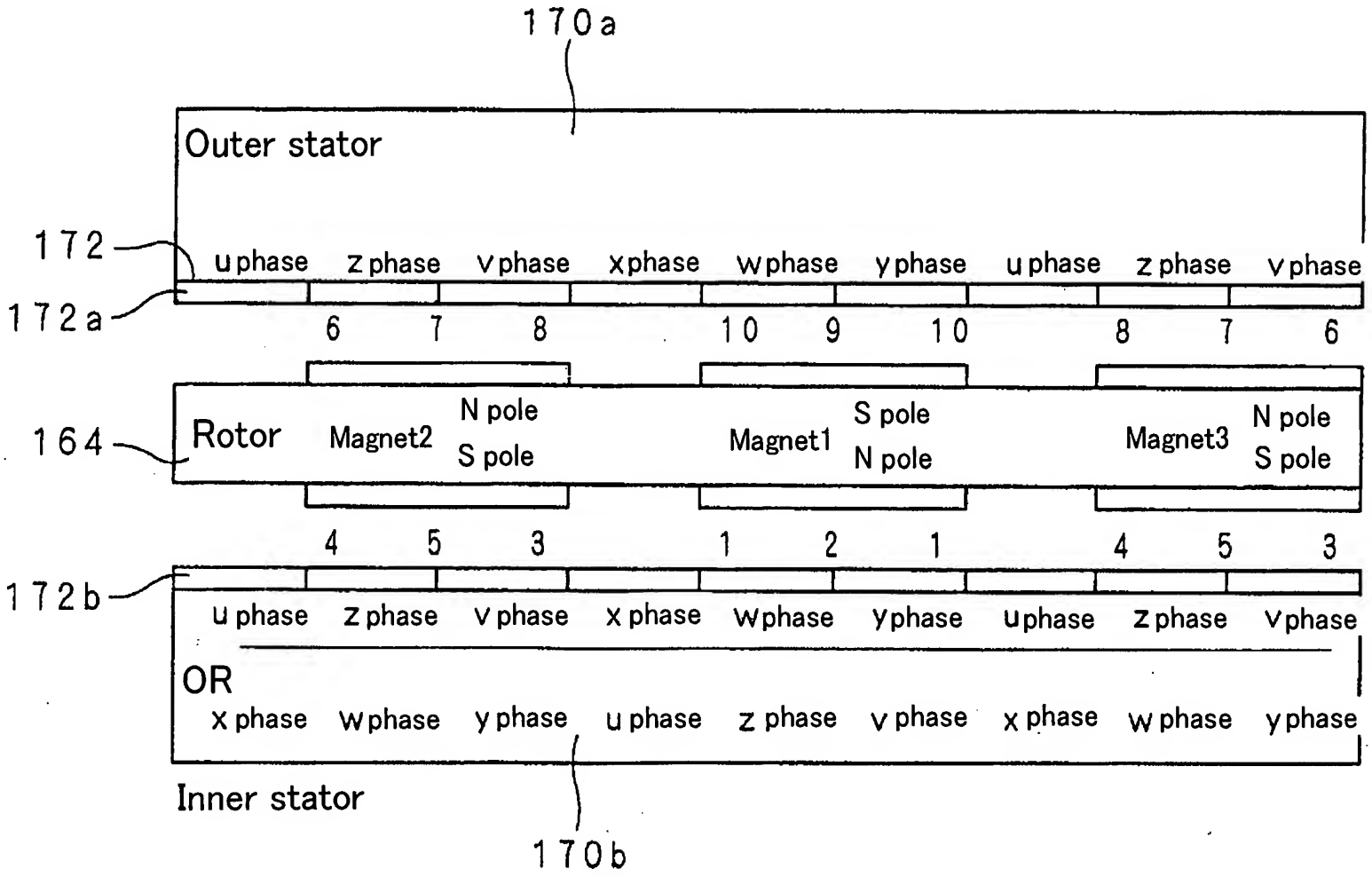

170a
Outer stator
172
172a
u phase
z phase
v phase
x phase
w phase
y phase
u phase
z phase
v phase
6
7
8
10
9
10
8
7
6
164
Rotor
Magnet2
N pole
S pole
Magnet1
S pole
N pole
Magnet3
N pole
S pole
4
5
3
1
2
1
4
5
3
172b
u phase
z phase
v phase
x phase
w phase
y phase
u phase
z phase
v phase
OR
x phase
w phase
y phase
u phase
z phase
v phase
x phase
w phase
y phase
Inner stator
170b

Fig. 50

Each phase crossing the coils of inside and outside	In the alignment of u,z,v,x,w,y (the upper stage of the inner stator of Figure 49)	In the alignment of u,z,v,x,w,y (the upper stage of the inner stator of Figure 49)
z phase	6+5=11	6+2=8
v phase	7+3=10	7+1=8
w phase	10+4=14	10+5=15
y phase	10+4=14	10+3=13
Sum	49	44

Fig. 51

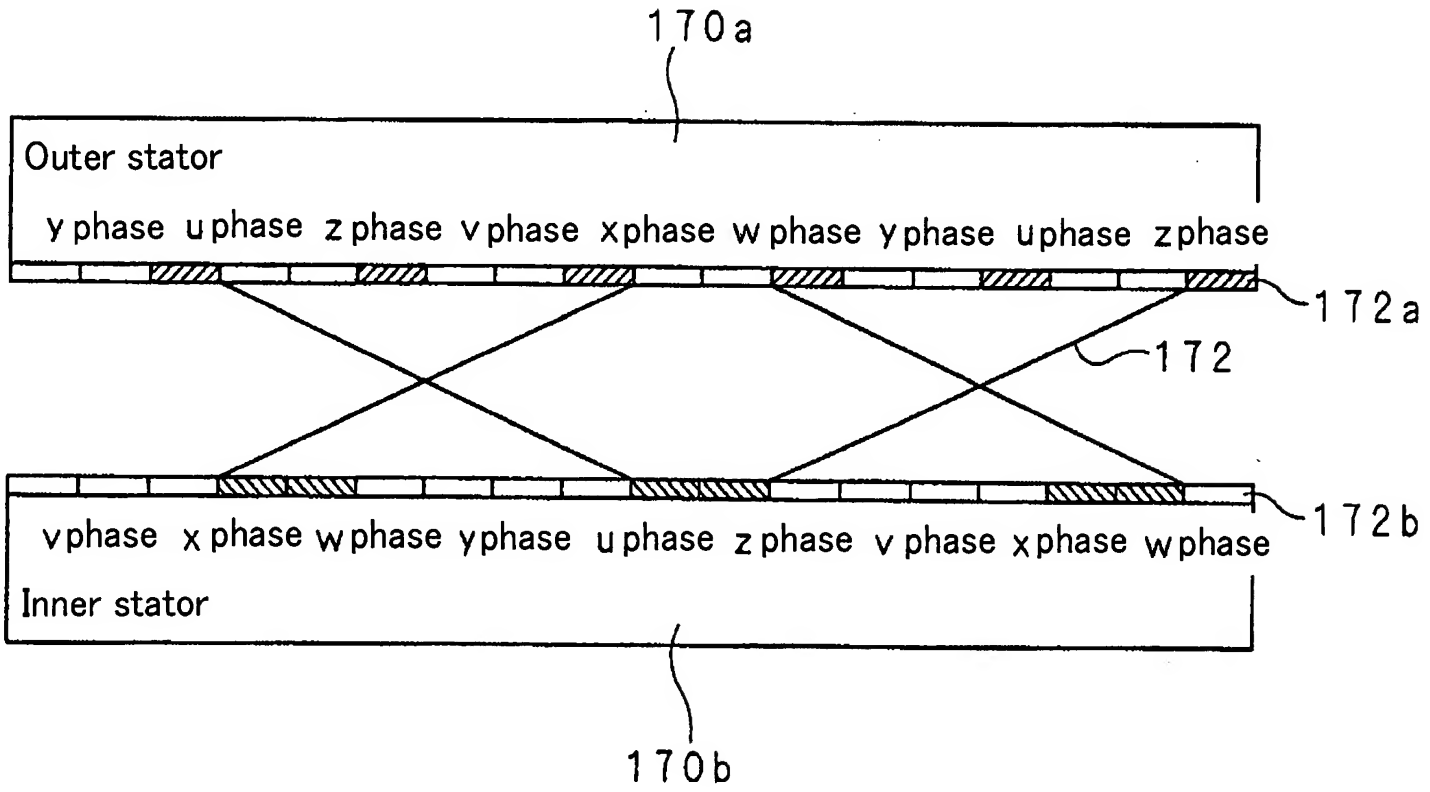
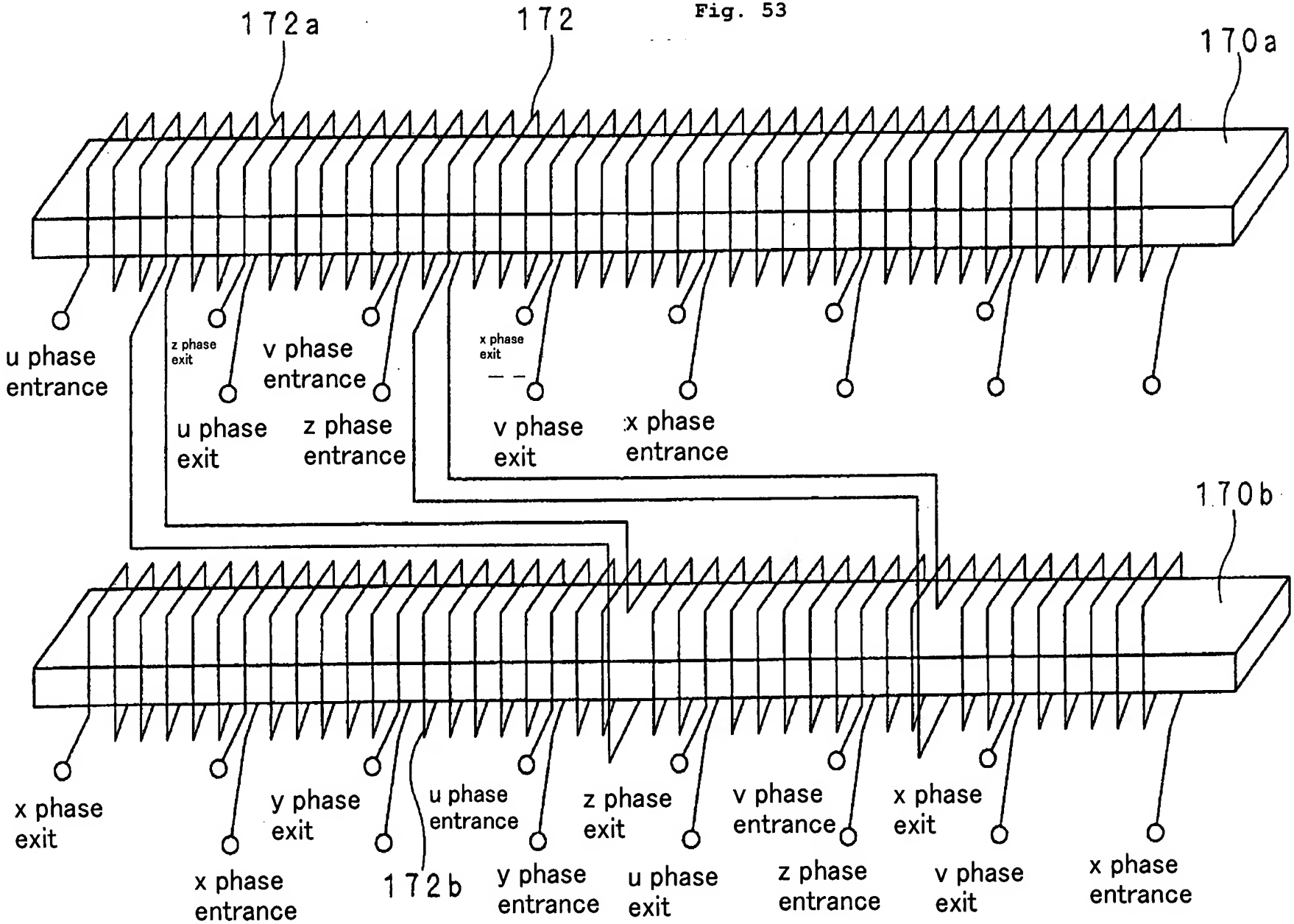

170a
Outer stator
y phase u phase z phase v phase x phase w phase y phase u phase z phase
172a
172
172b
v phase x phase w phase y phase u phase z phase v phase x phase w phase
Inner stator
170b

Fig. 52

Fig. 53


172a
172
170a
u phase entrance
z phase exit
u phase exit
v phase entrance
z phase entrance
x phase exit
v phase exit
x phase entrance
170b
x phase exit
x phase entrance
y phase exit
172b
u phase entrance
y phase entrance
z phase exit
u phase exit
v phase entrance
z phase entrance
x phase exit
v phase exit
x phase entrance

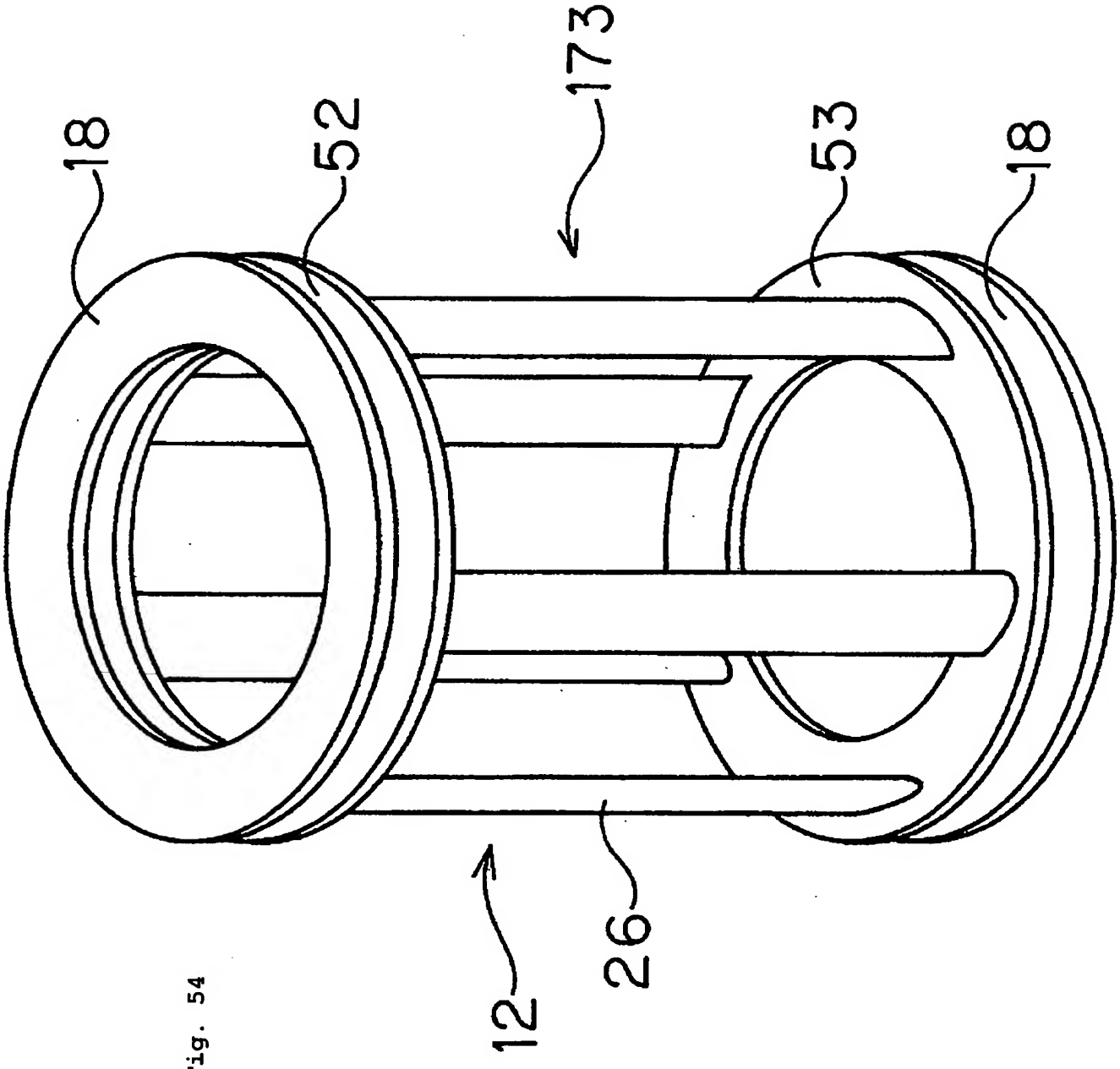


Fig. 54

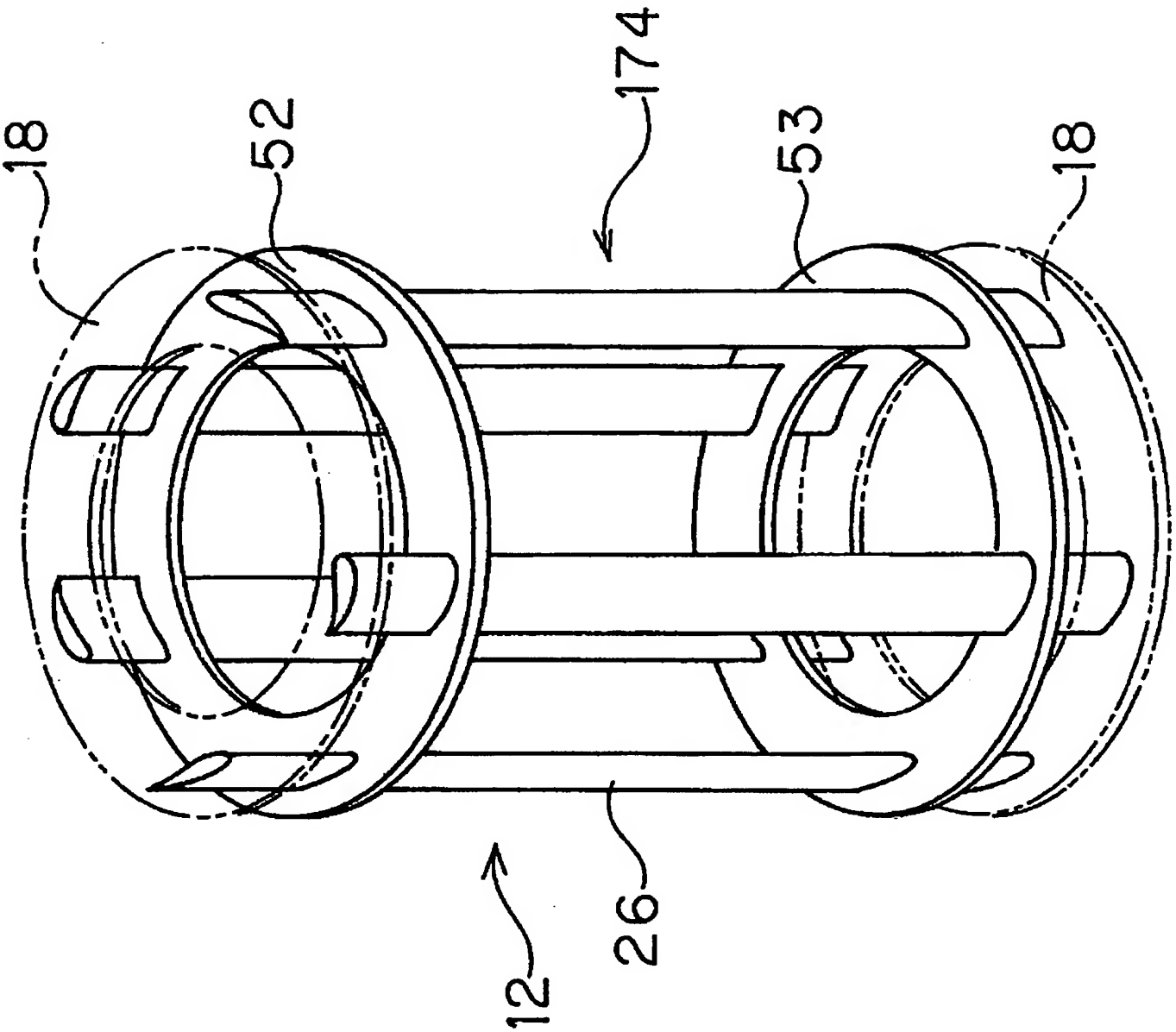
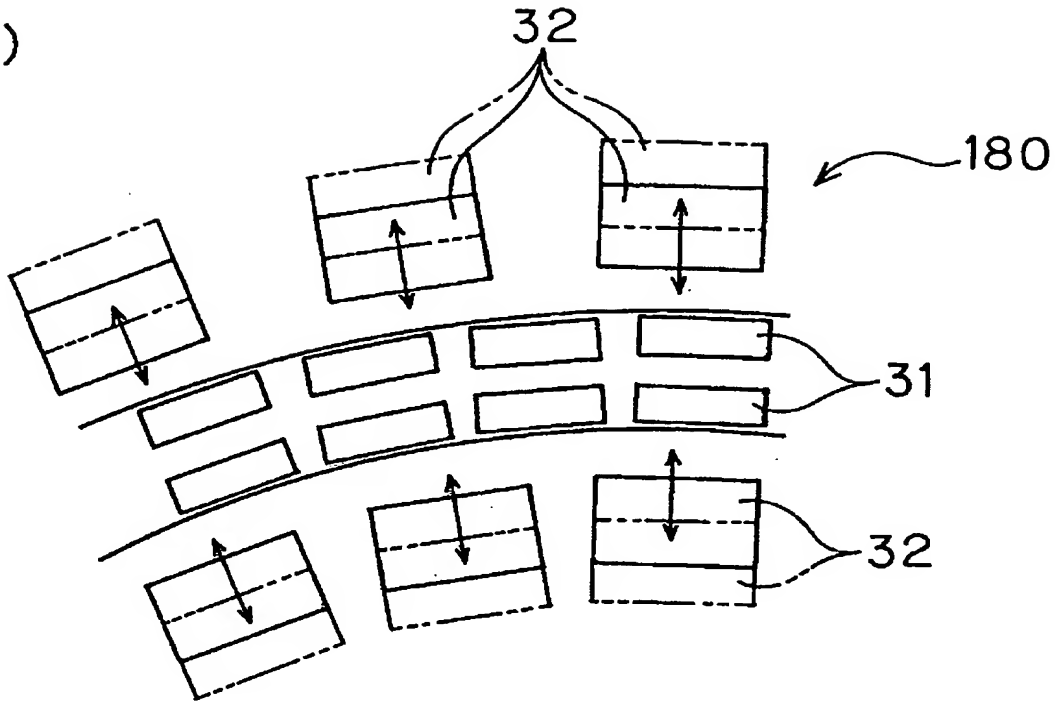


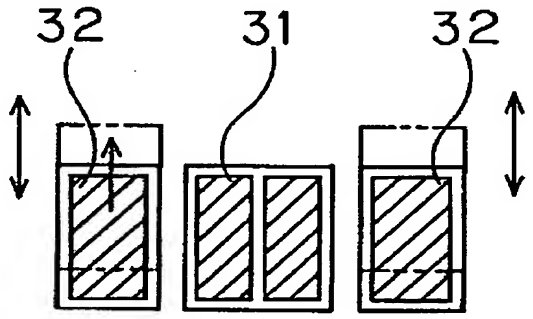
Fig. 55

Fig. 56

(a)



(b)



(c)

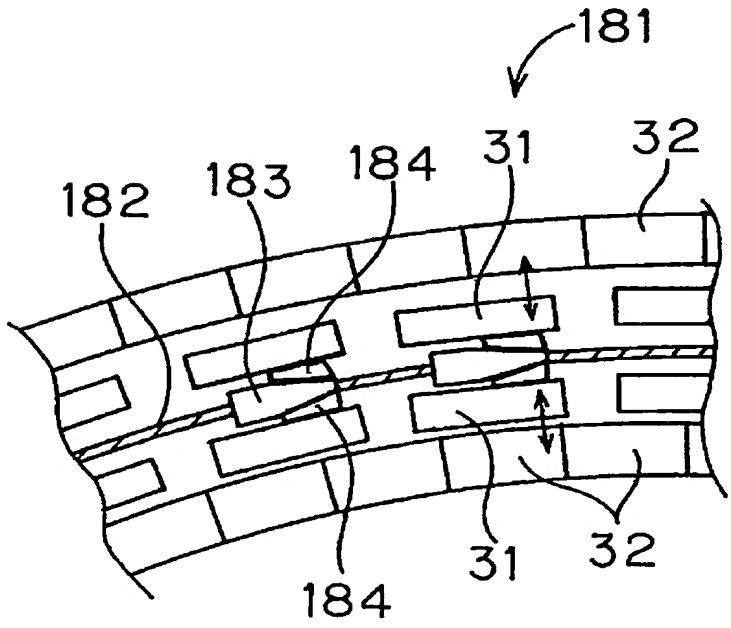
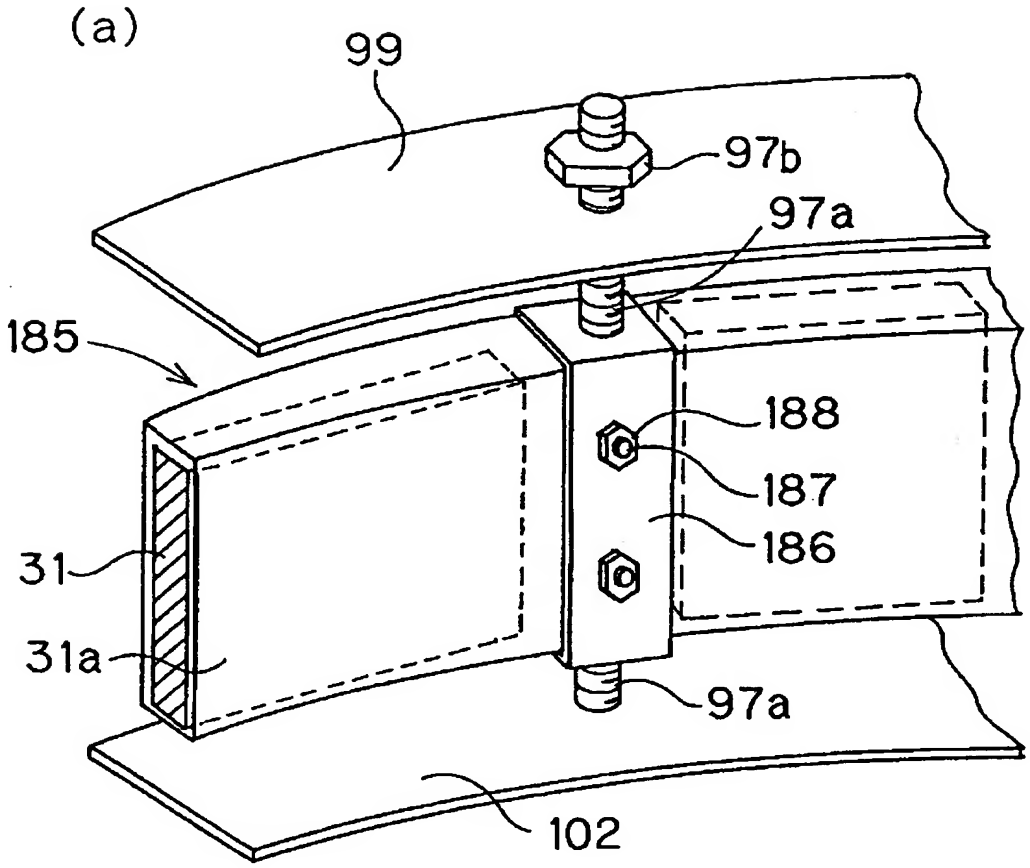
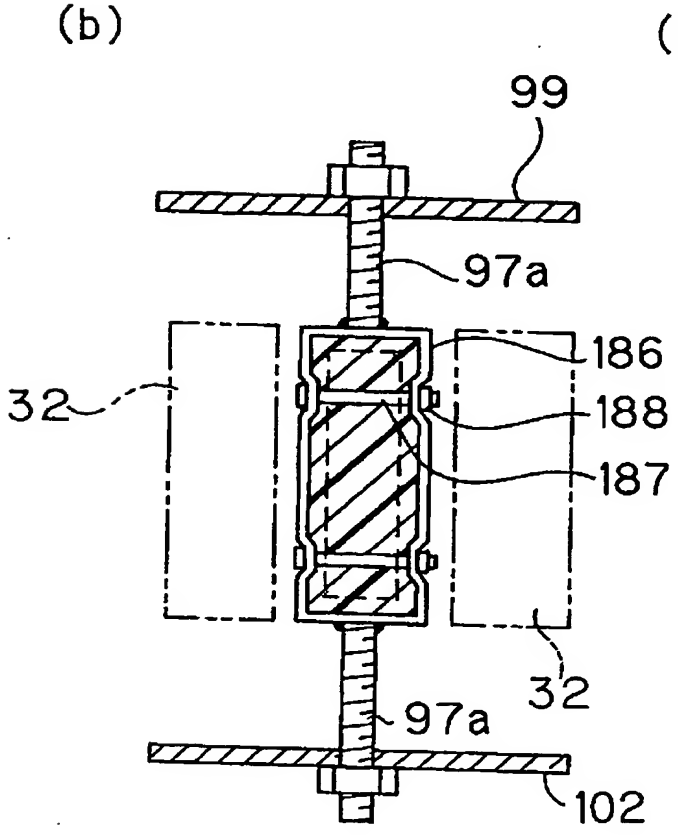


Fig. 57


(a)
99
97b
97a
185
188
187
186
31
31a
97a
102


(b)
99
97a
186
32
188
187
32
97a
102

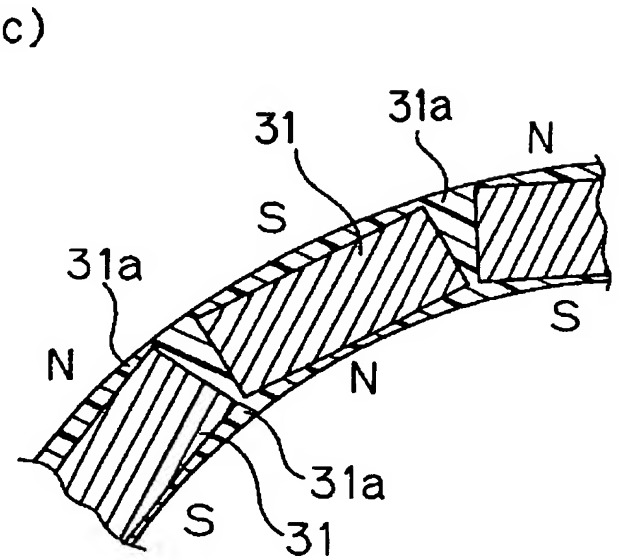
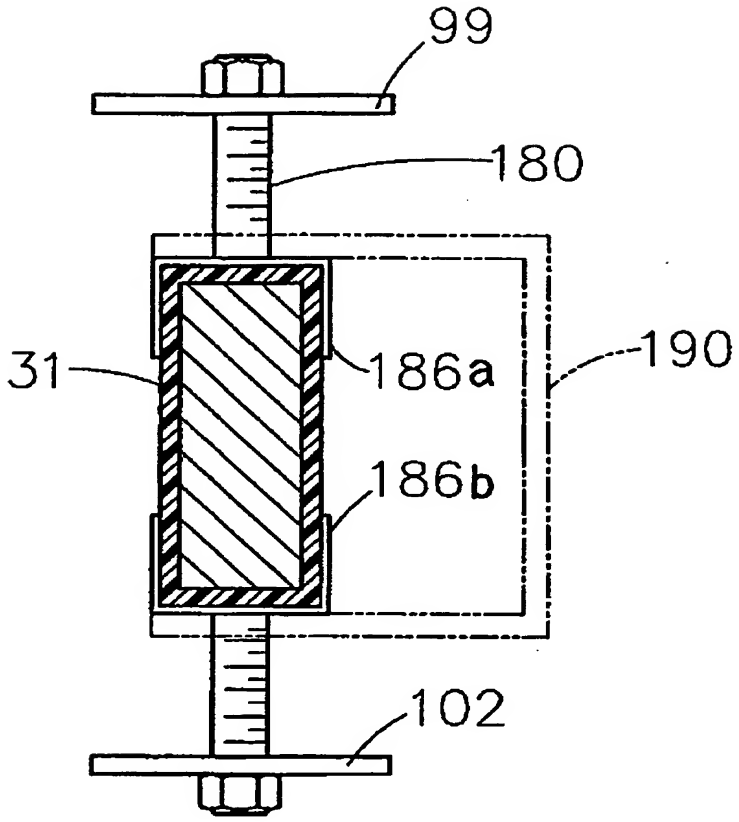

(c)
31
31a
N
S
31a
S
N
N
31a
S
31

Fig. 58

(a)



(b)

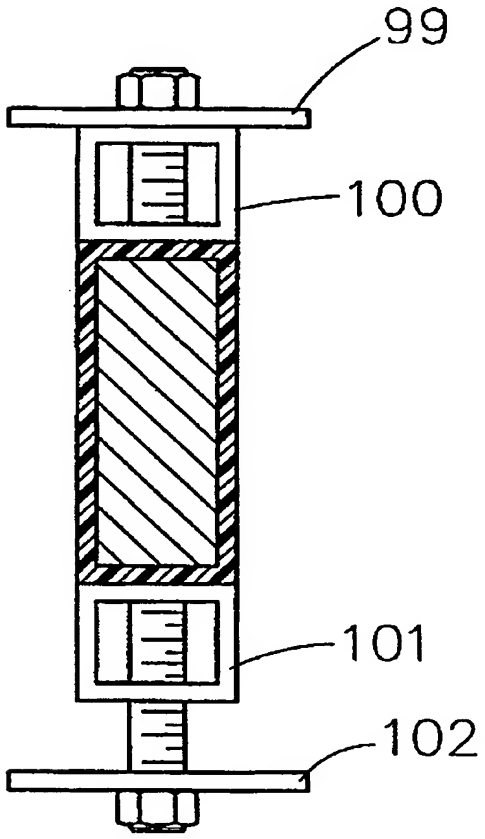
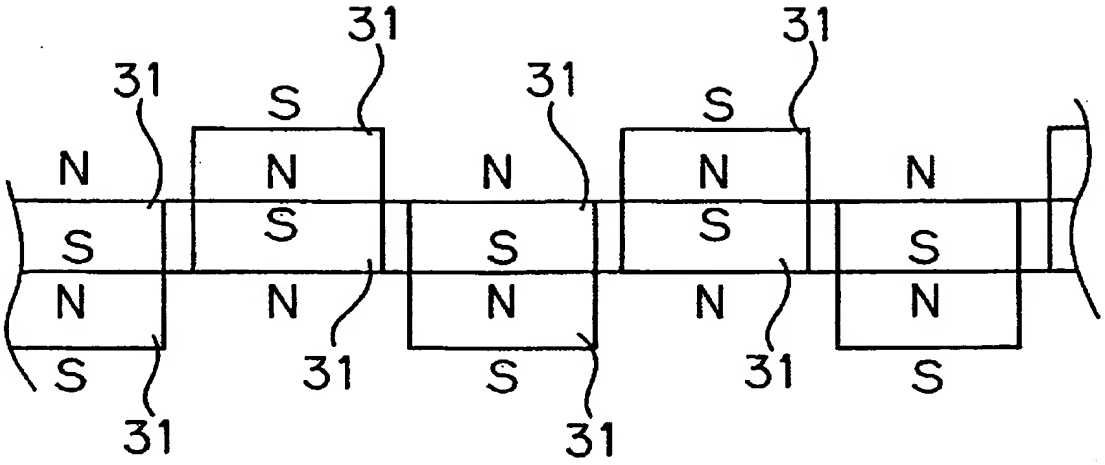
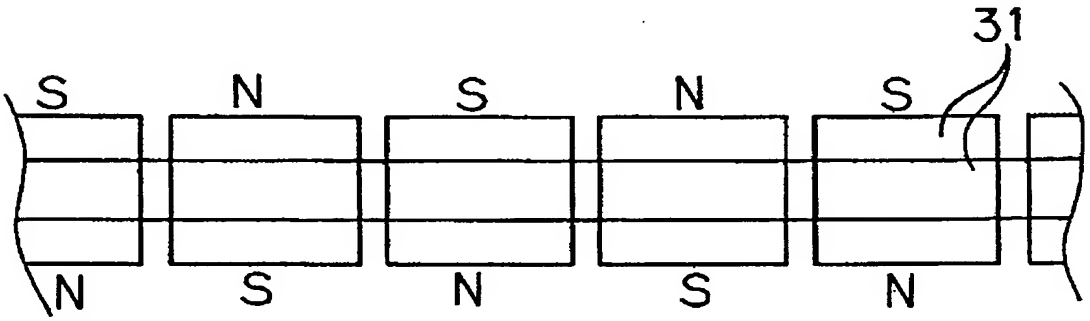


Fig. 59

(a)


31
31
31
31
S
S
S
N
N
N
N
N
N
S
S
S
S
S
N
N
N
N
N
S
S
S
31
31
31
31

(b)


31
S
N
S
N
S
N
S
N
S
N

(c)

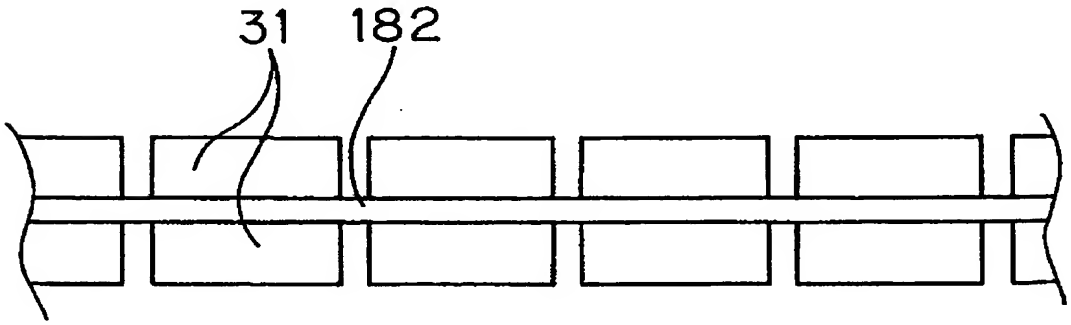

31
182

Fig. 60

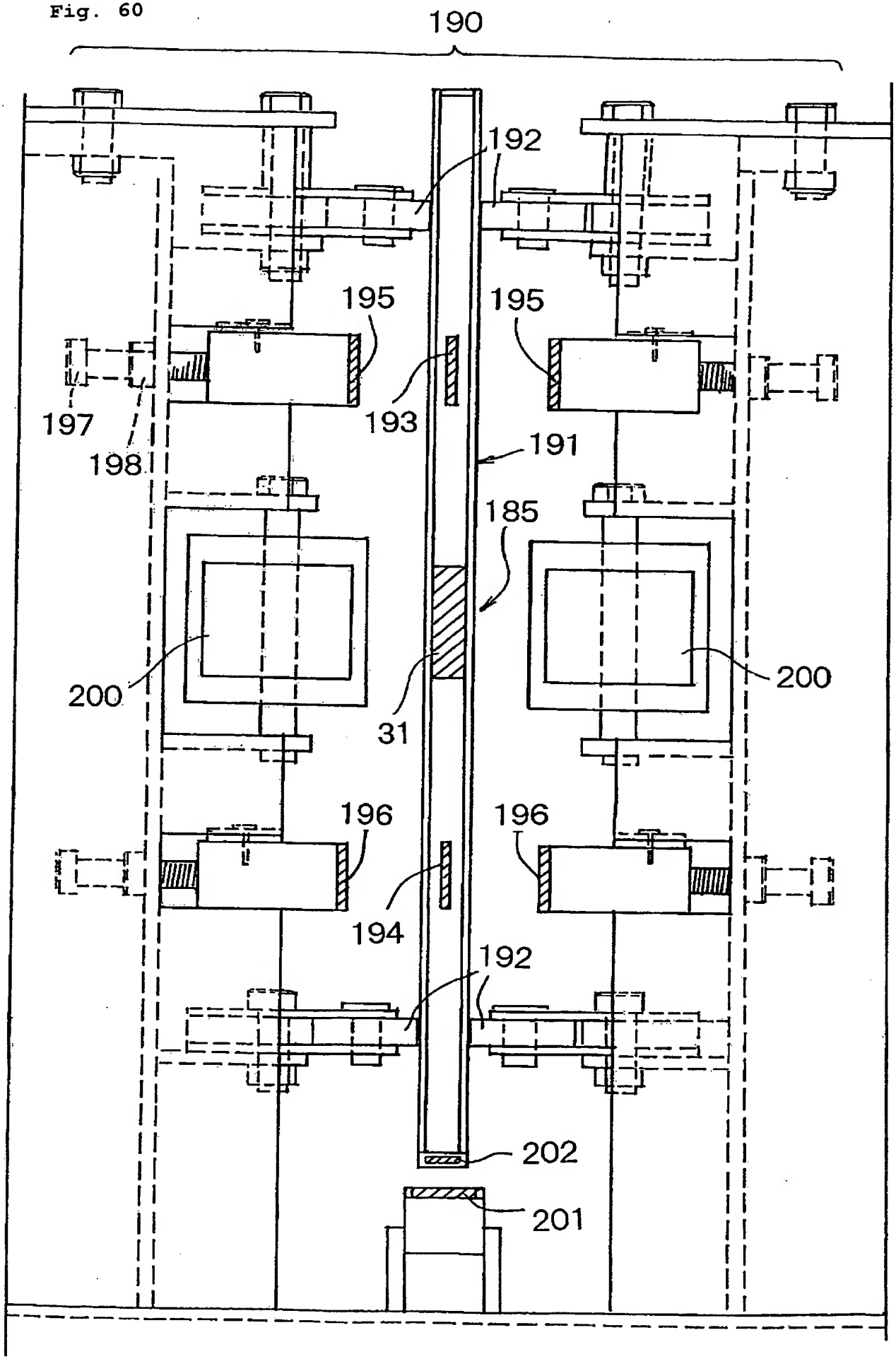
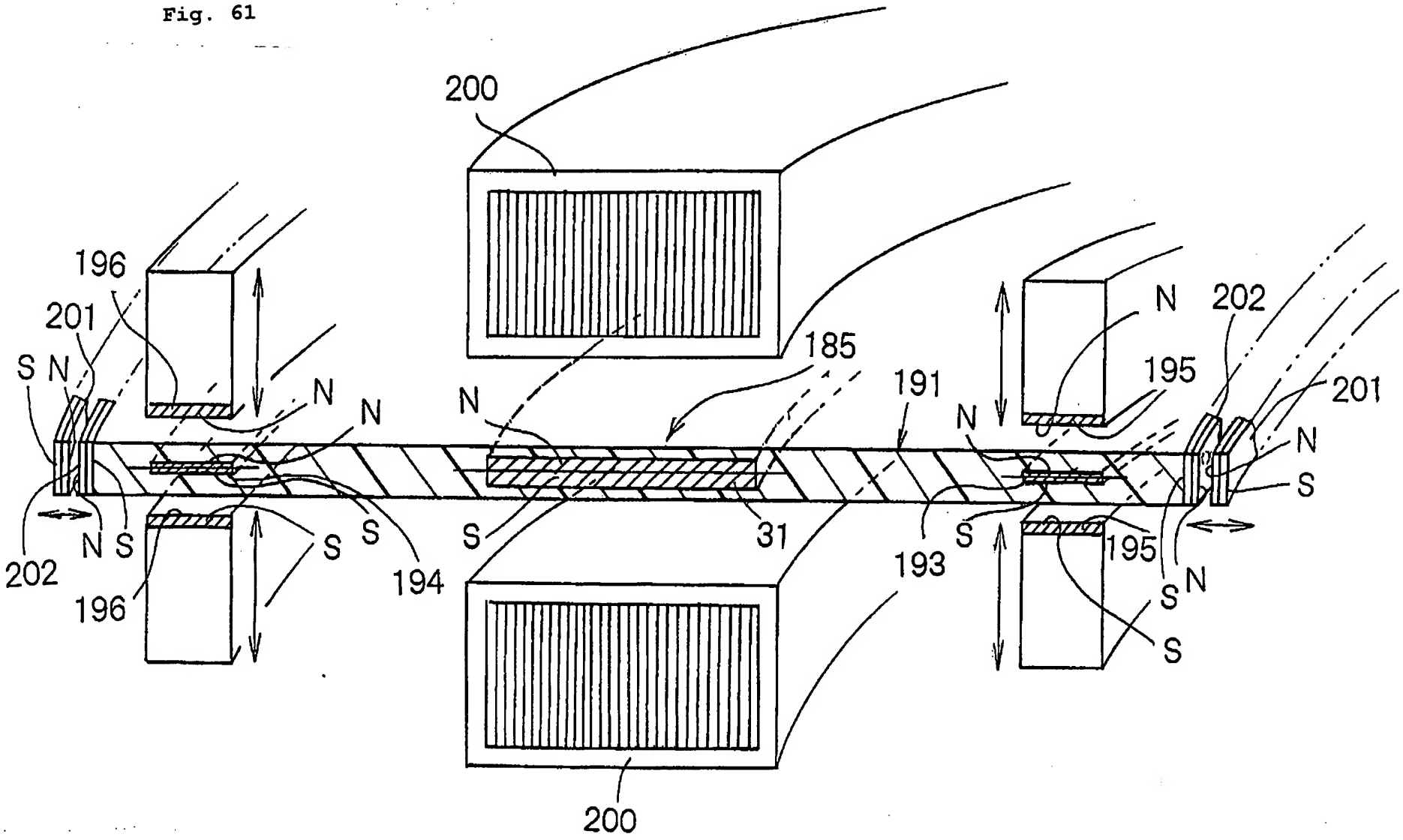

190
192
195
195
197
193
198
191
185
200
200
31
196
196
194
192
202
201

Fig. 61


200
196
201
S N
N
N
N
185
191
N
195
202
201
N
S
202
N S
S
S
S
194
31
193
S
195
S N
S
196
200

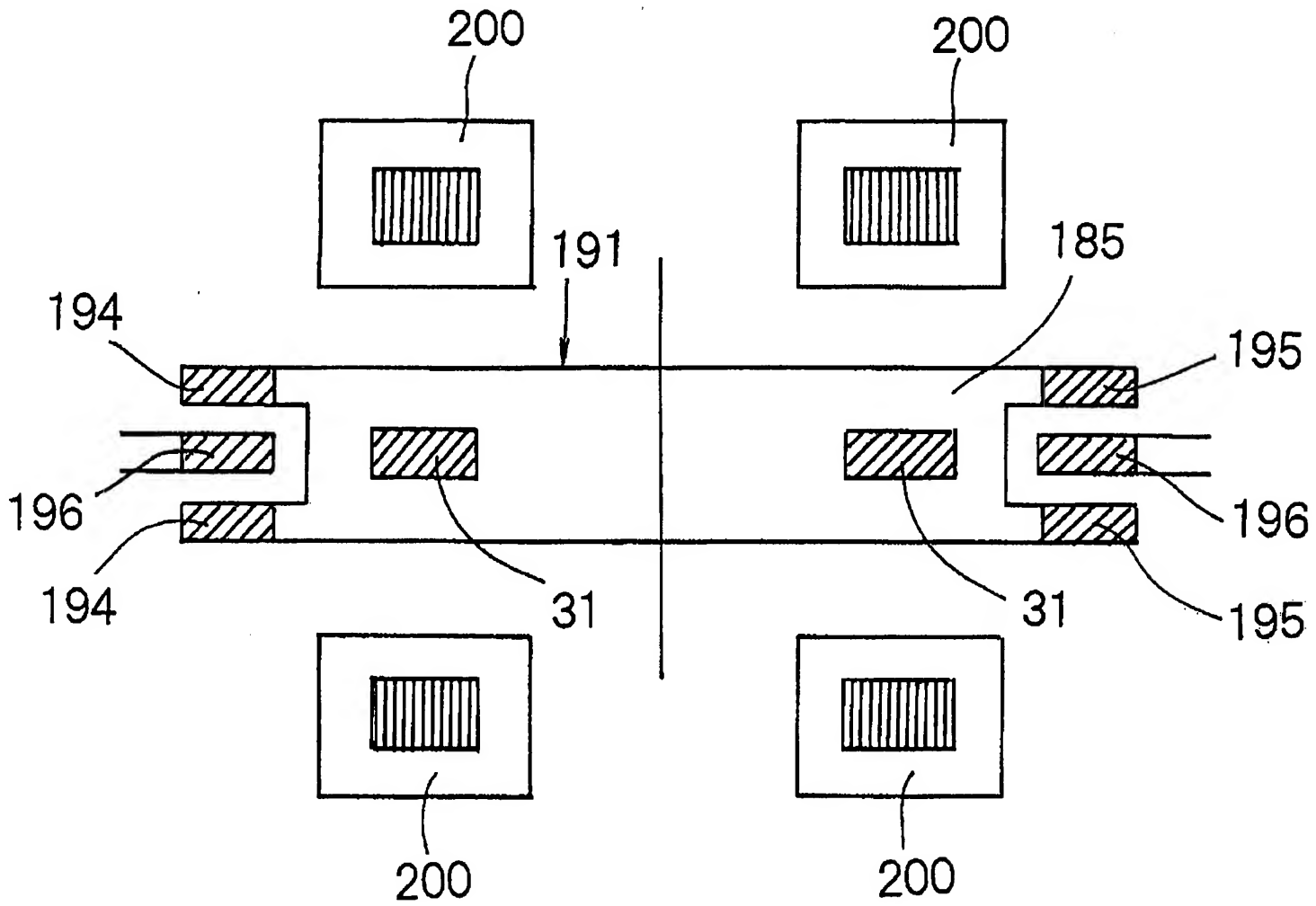


Fig. 62

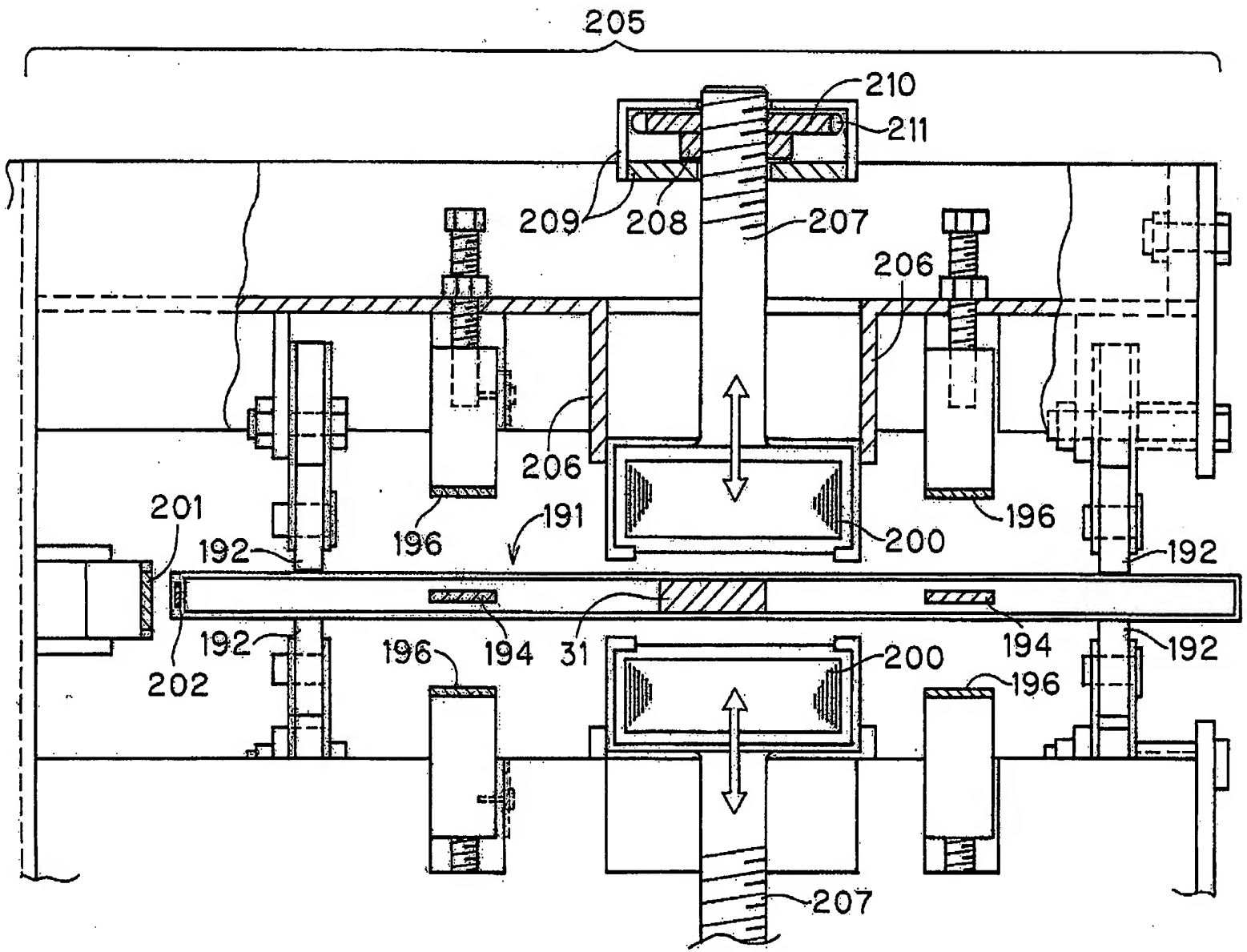
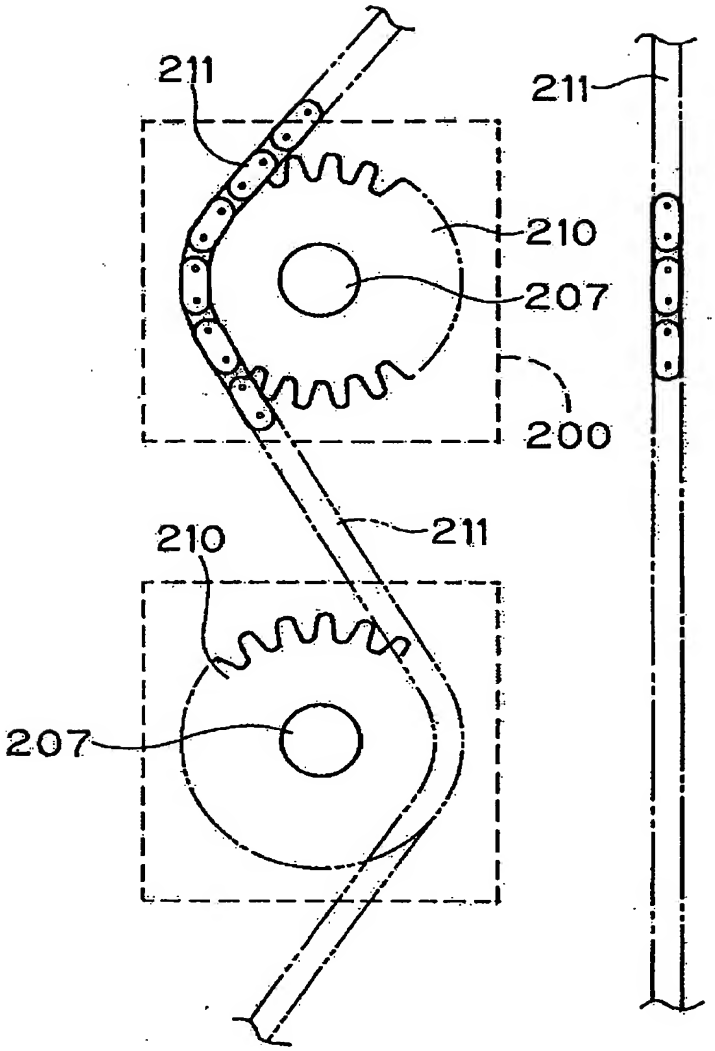

205
210
211
209
208
207
206
206
201
192
196
191
200
196
192
192
202
194
31
194
192
196
200
196
207

Fig. 63

Fig. 64



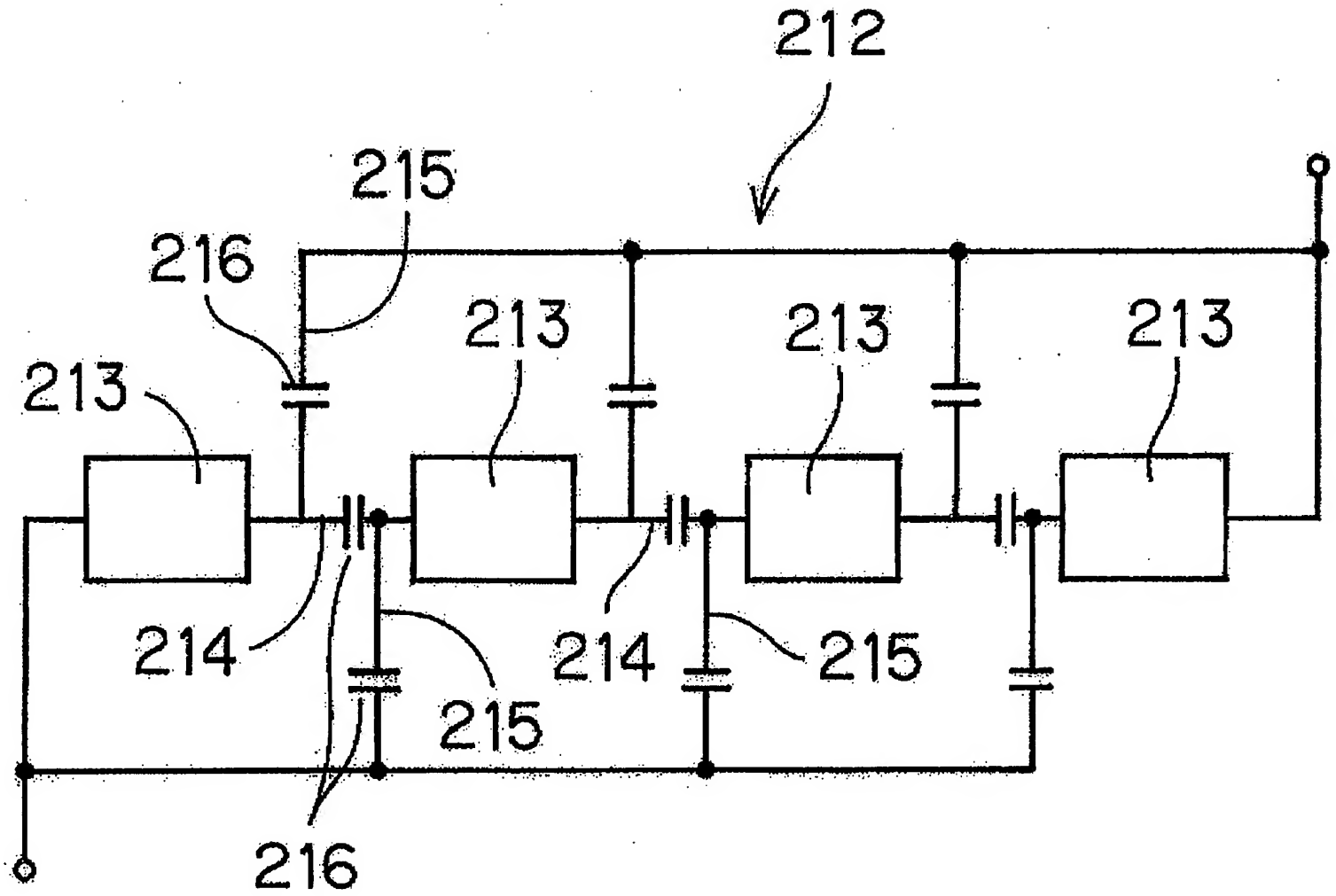


Fig. 65

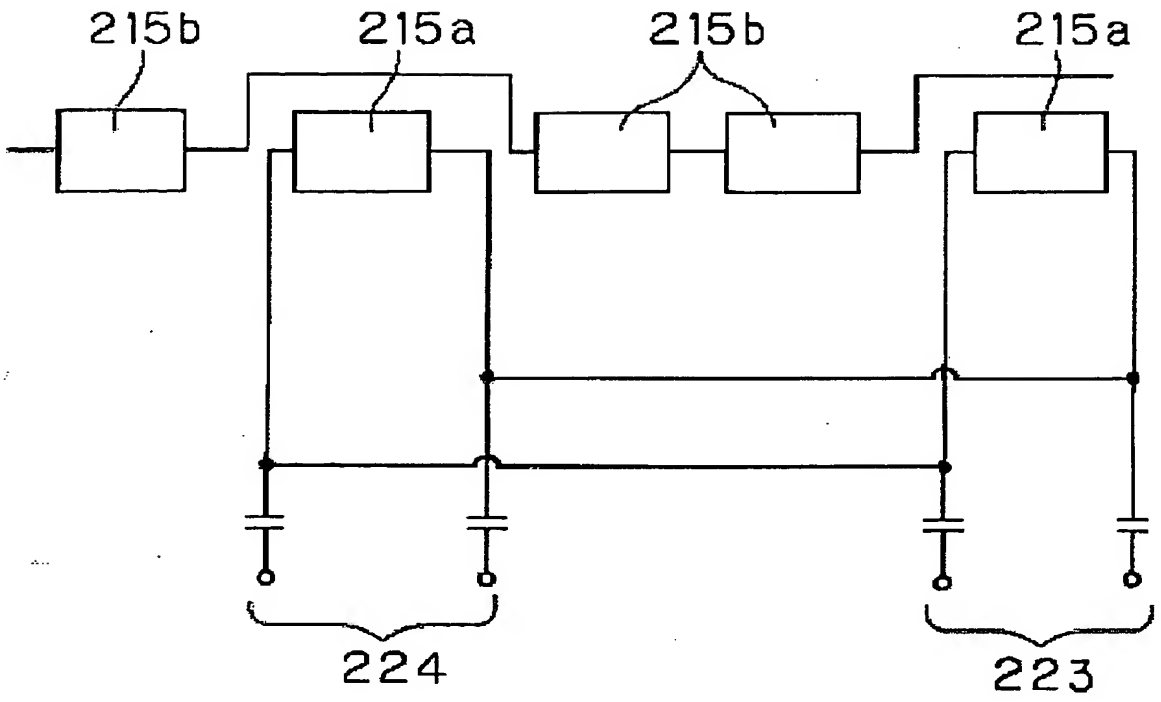
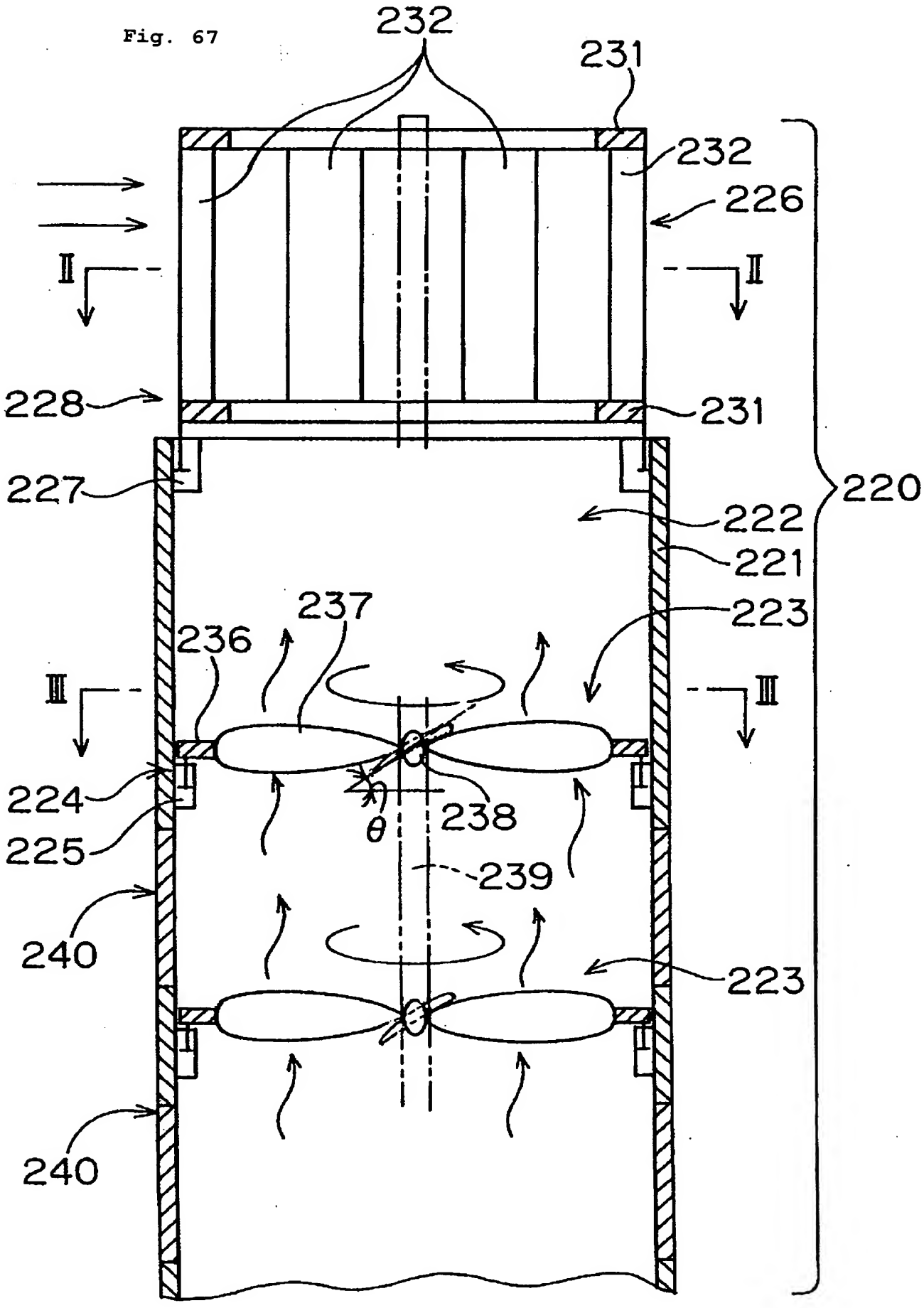


Fig. 66

Fig. 67


232
231
232
226
II
II
228
231
227
220
222
221
237
223
236
III
III
224
238
θ
225
239
240
223
240

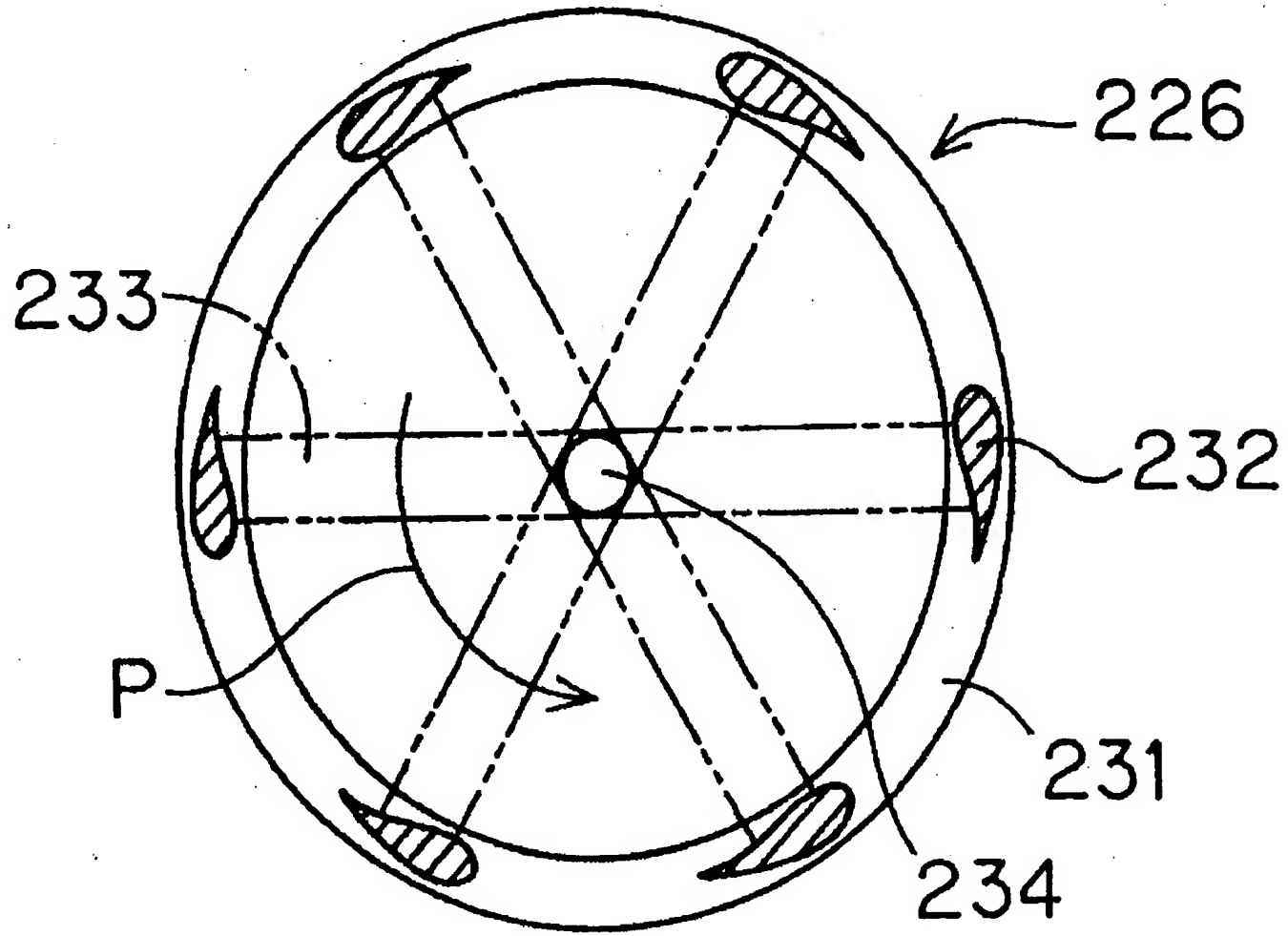


Fig. 68

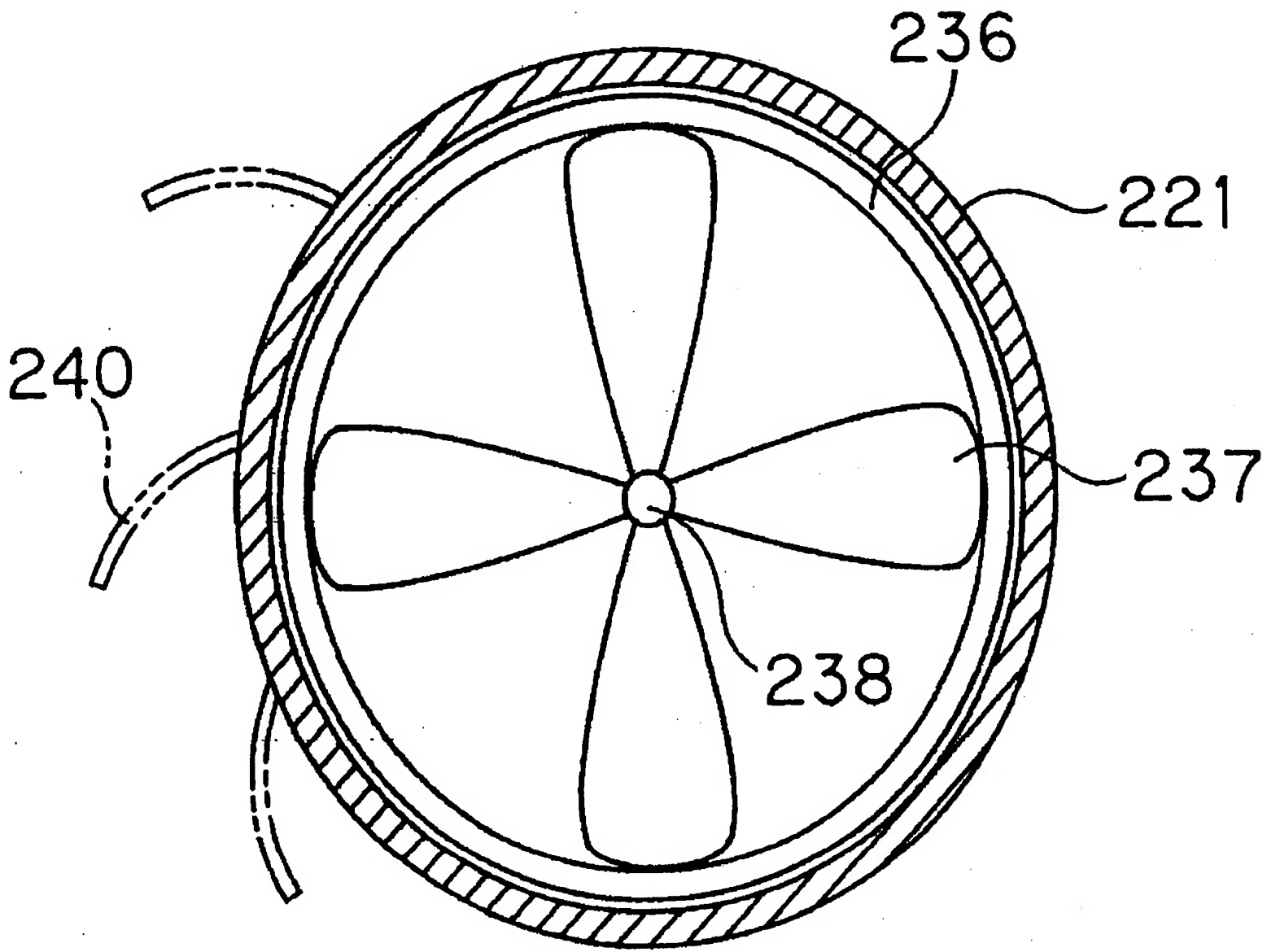
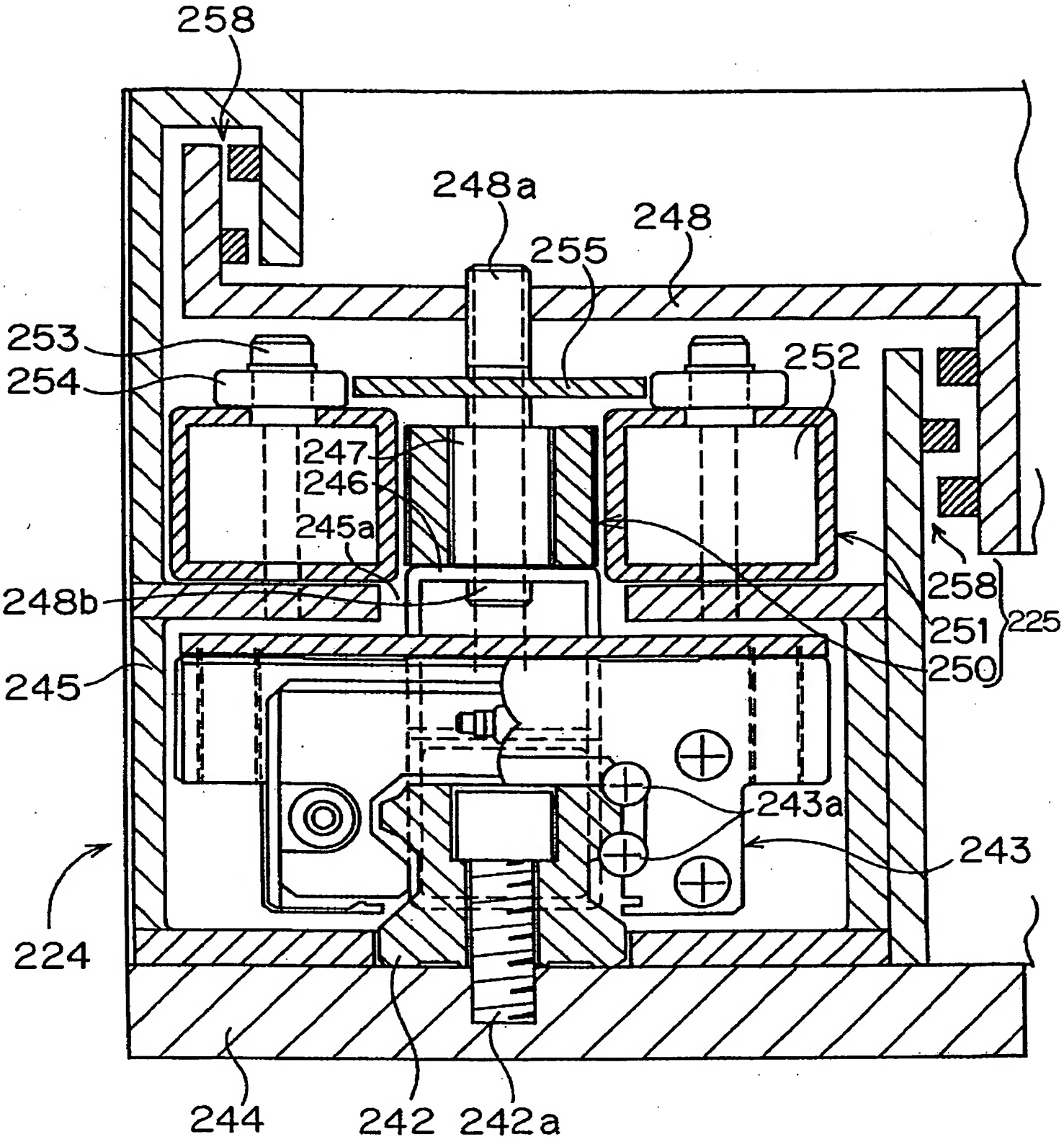


Fig. 69

Fig. 70


258
248a
248
255
253
254
252
247
246
245a
248b
258
251
225
250
245
243a
243
224
244
242
242a

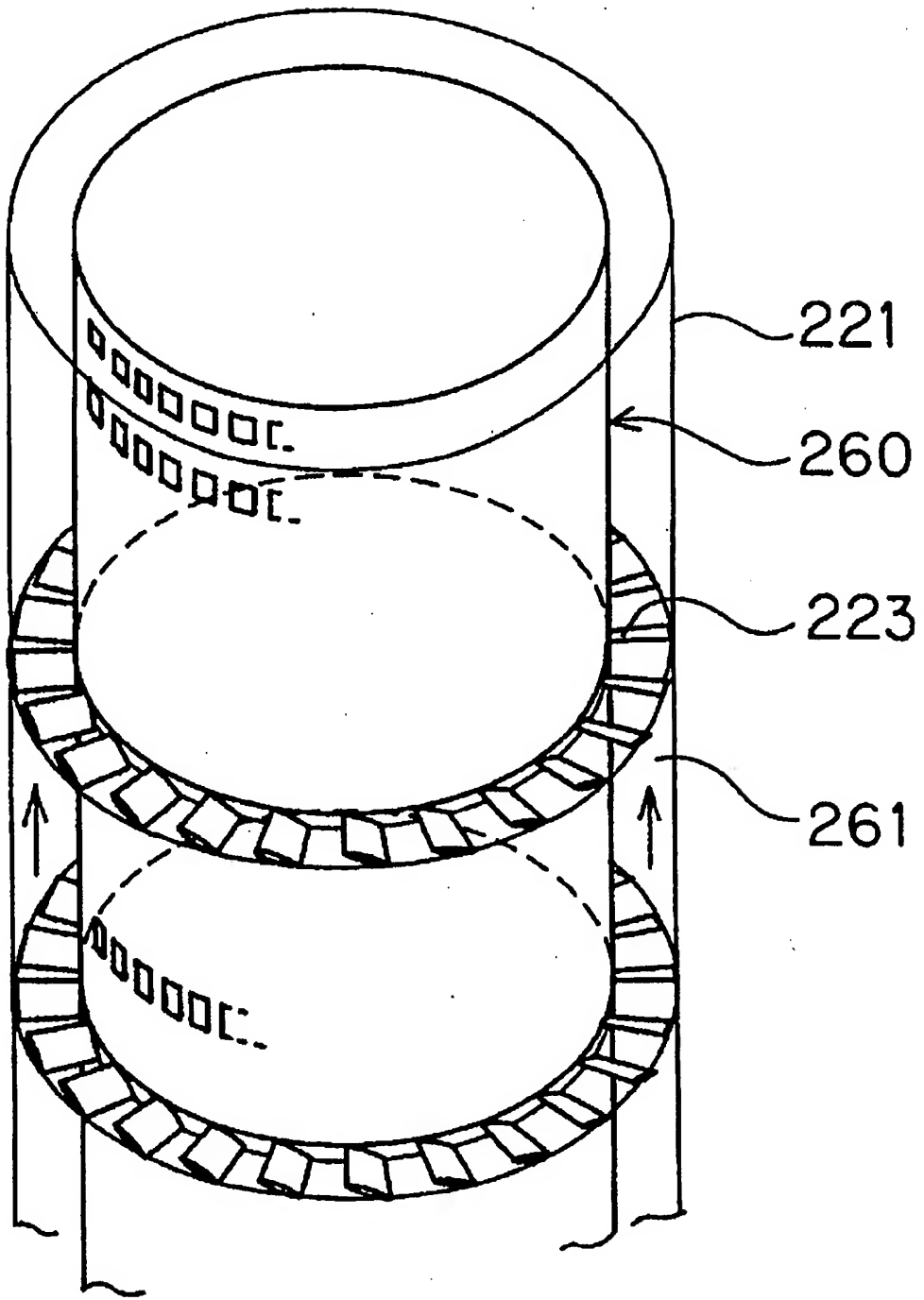


Fig. 71

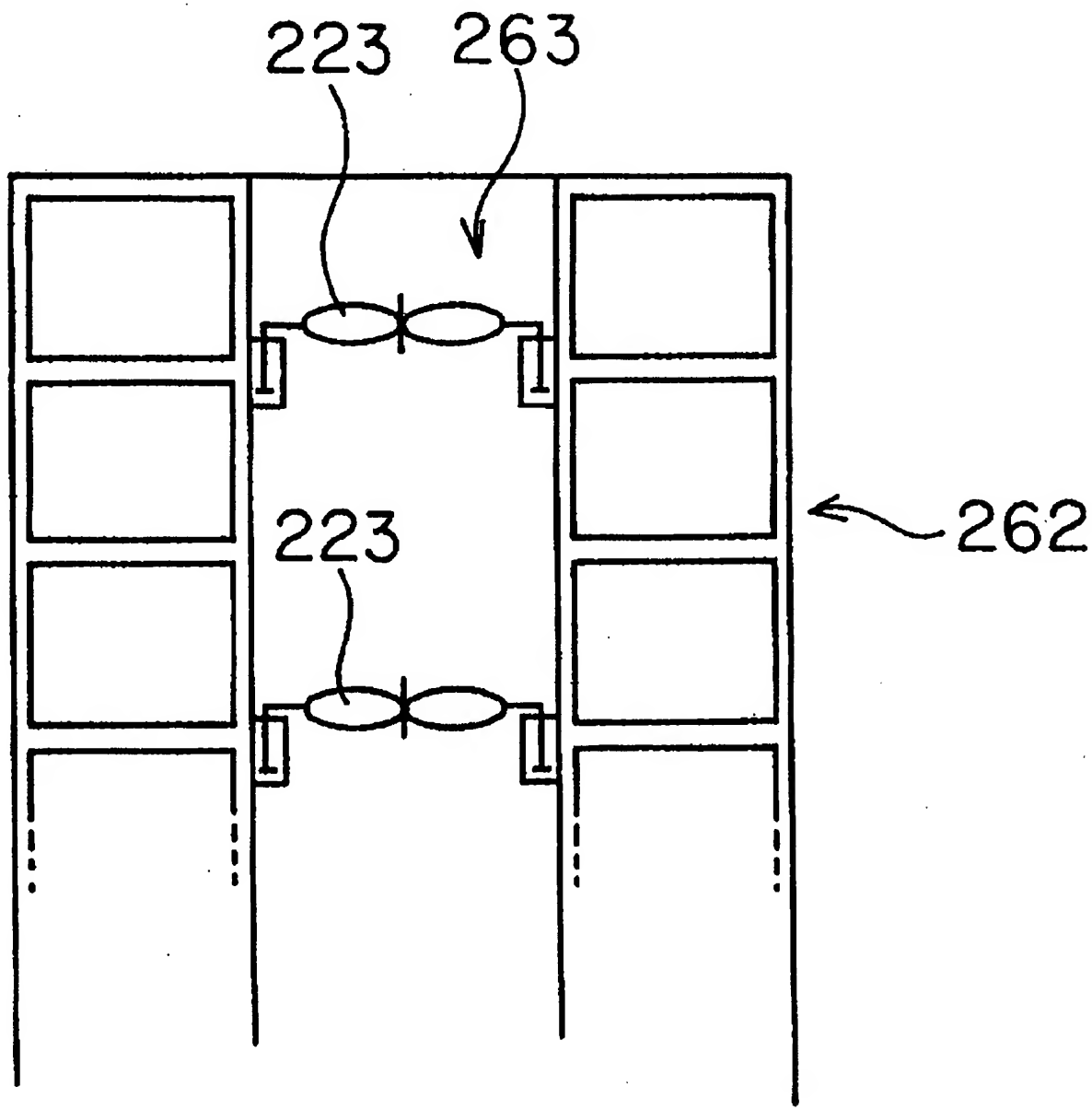


Fig. 72

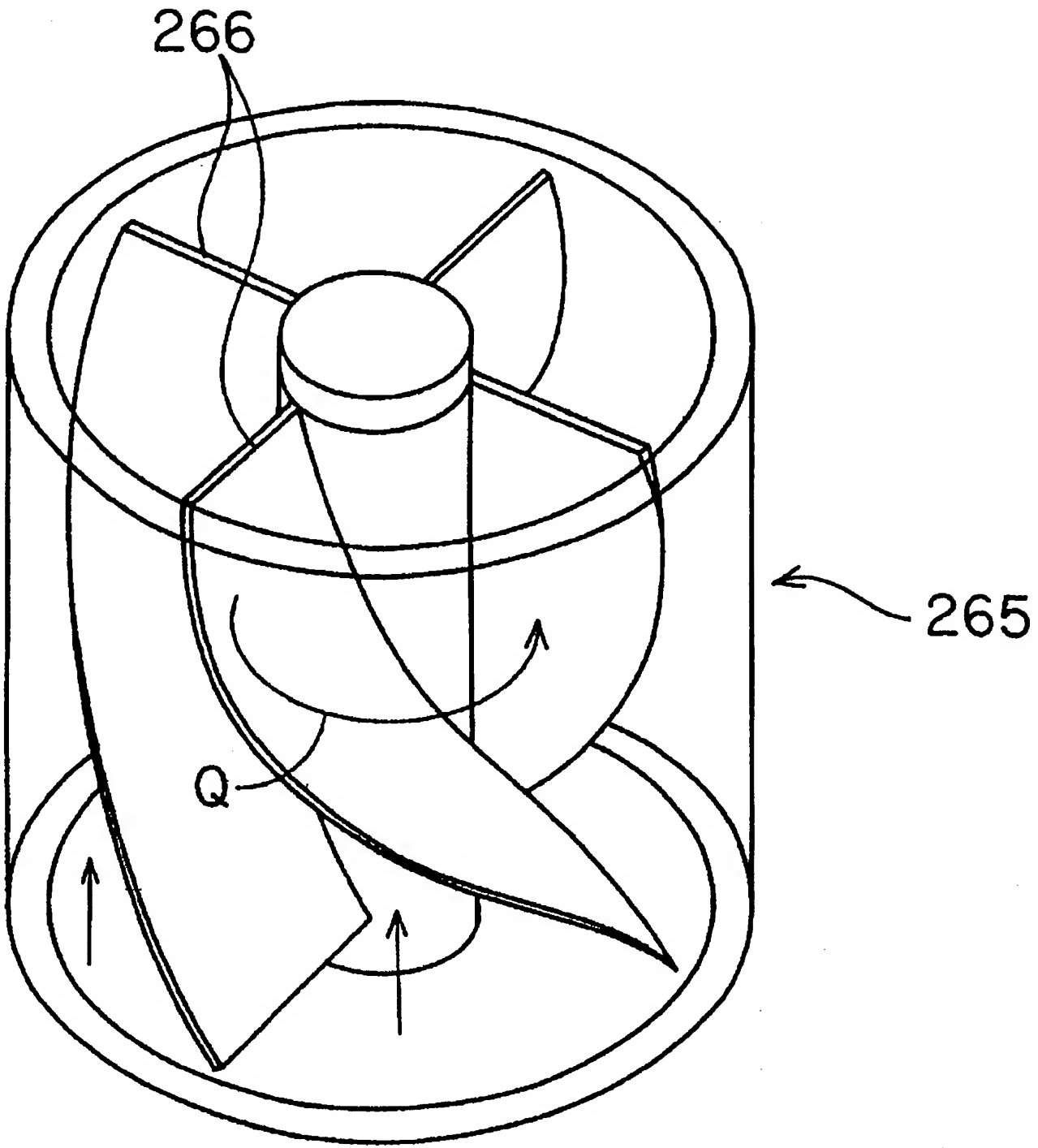


Fig. 73

Fig. 74

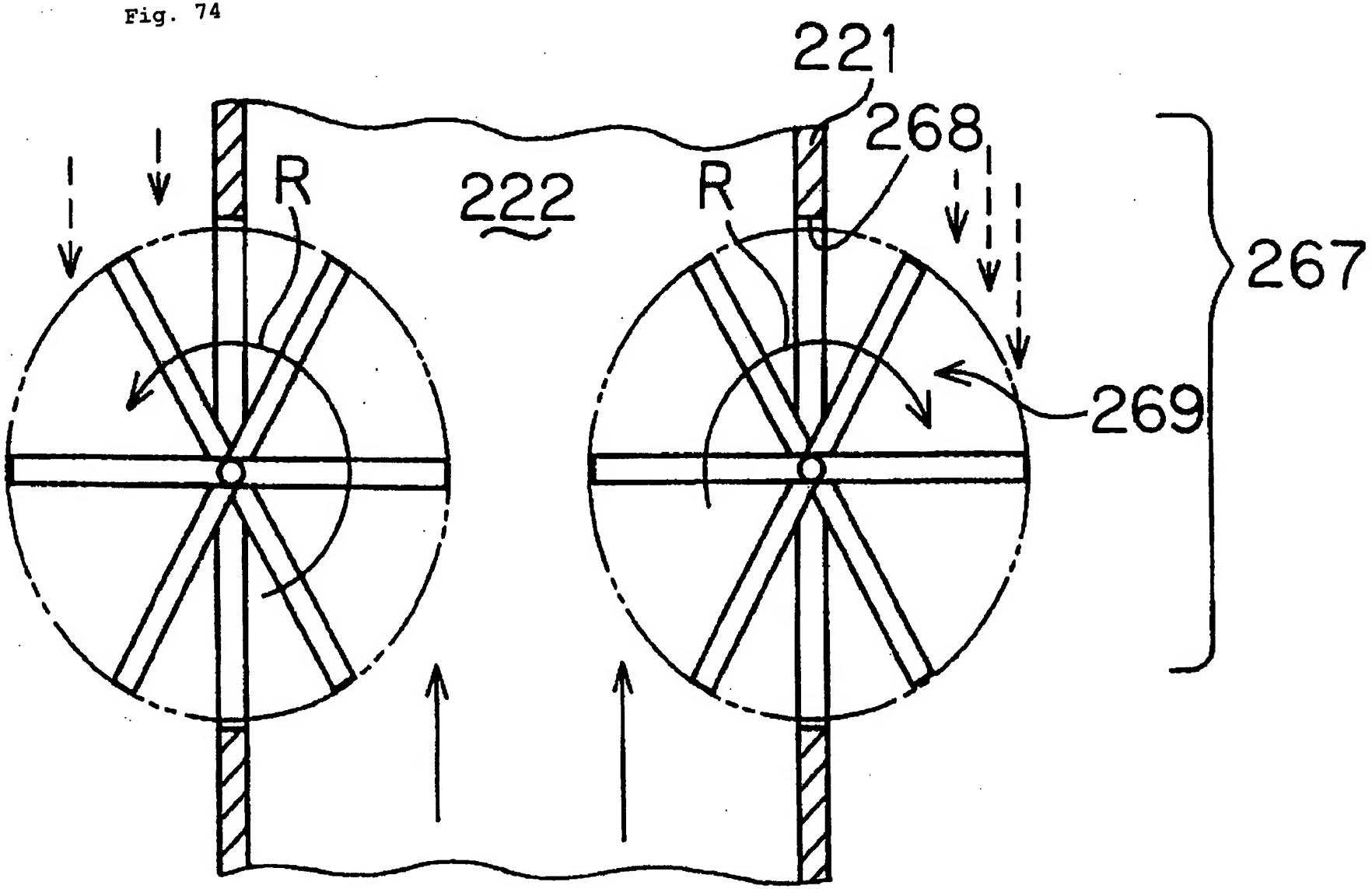


Fig. 75

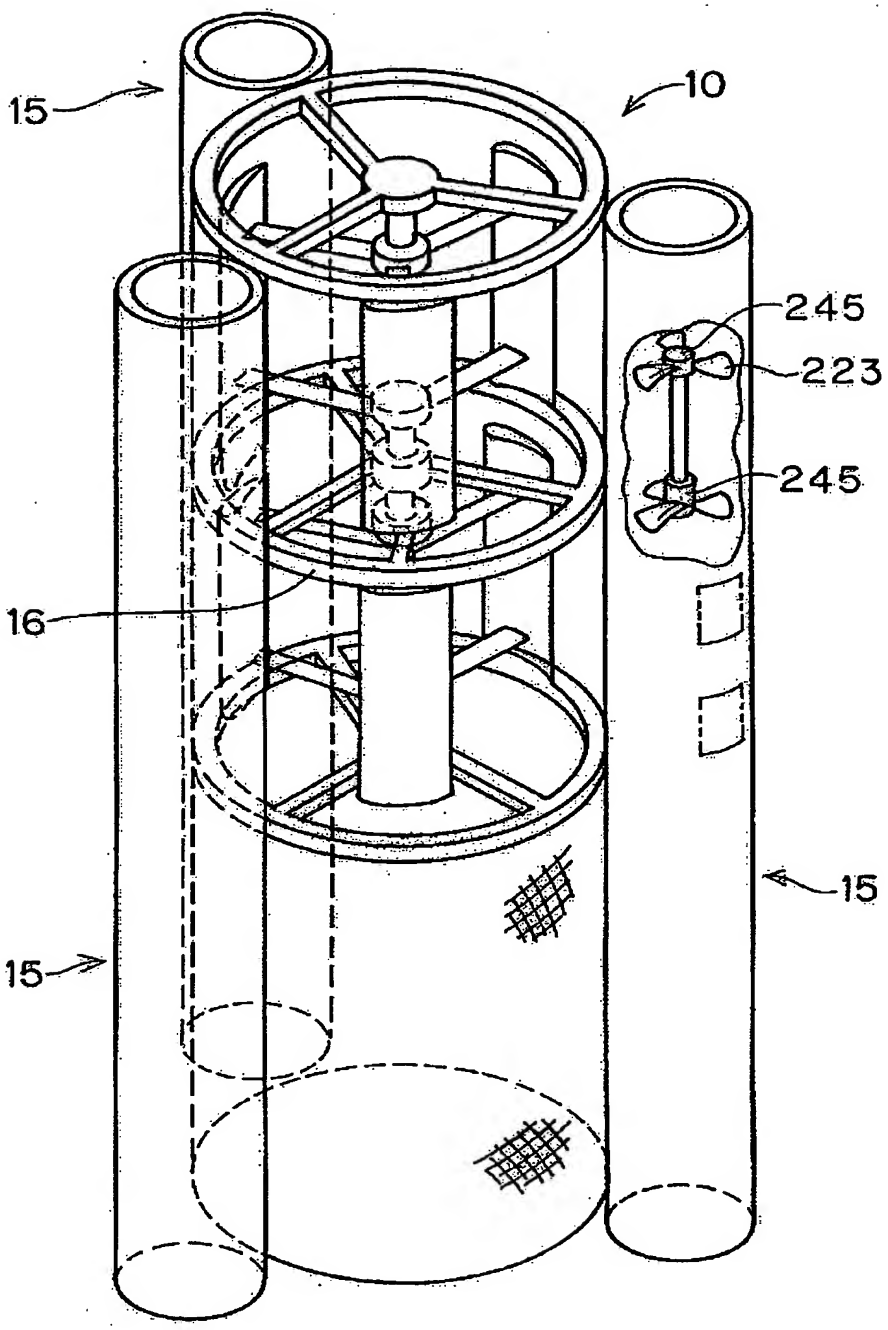


Fig. 76

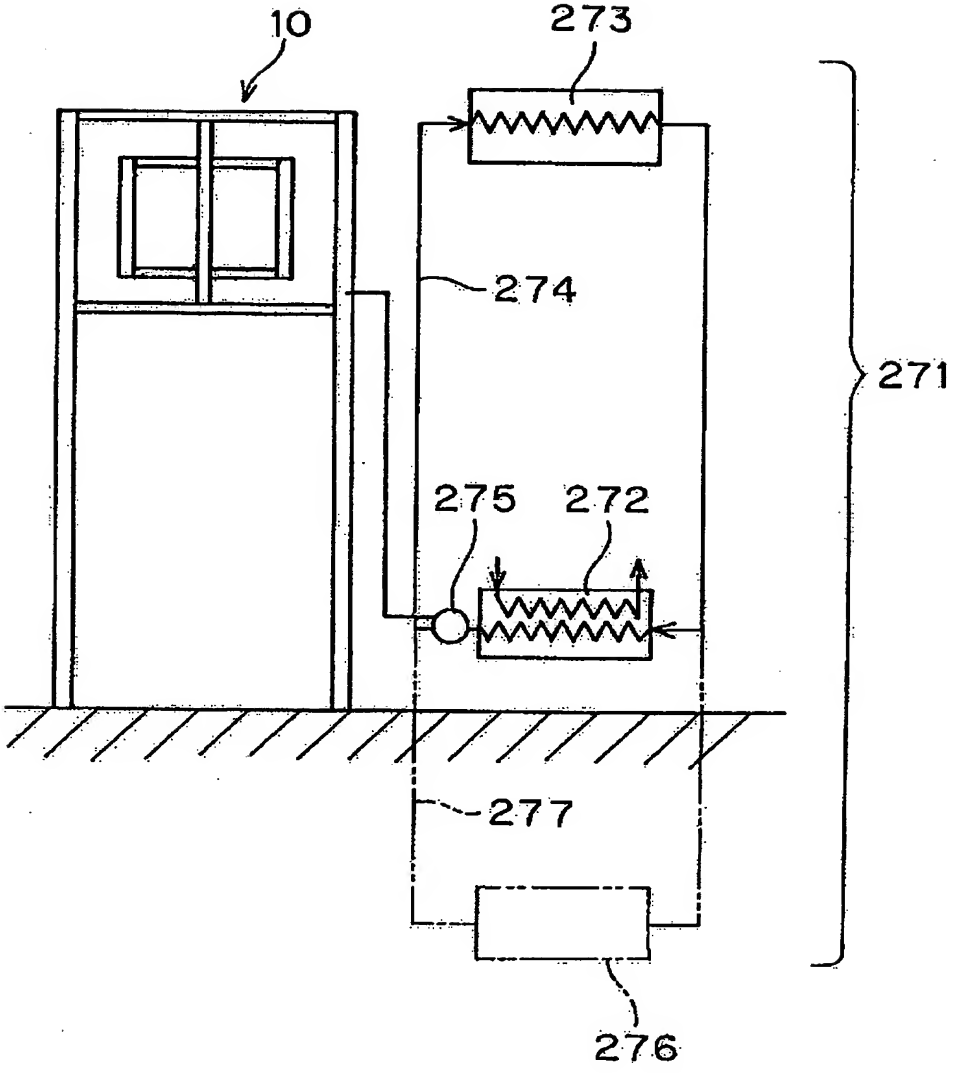
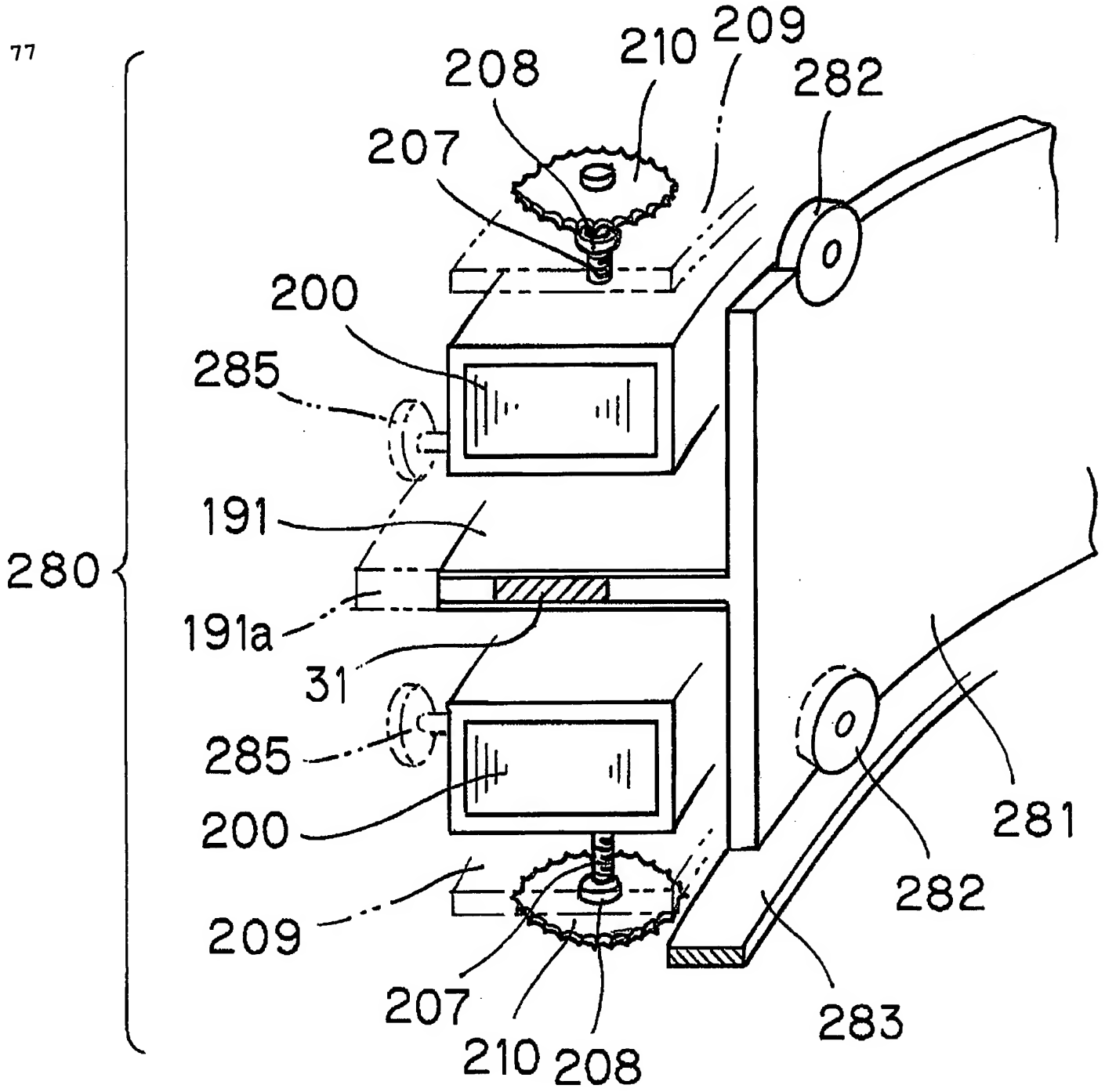


Fig. 77


208
210
209
282
207
200
285
191
280
191a
31
285
200
209
207
210
208
283
282
281

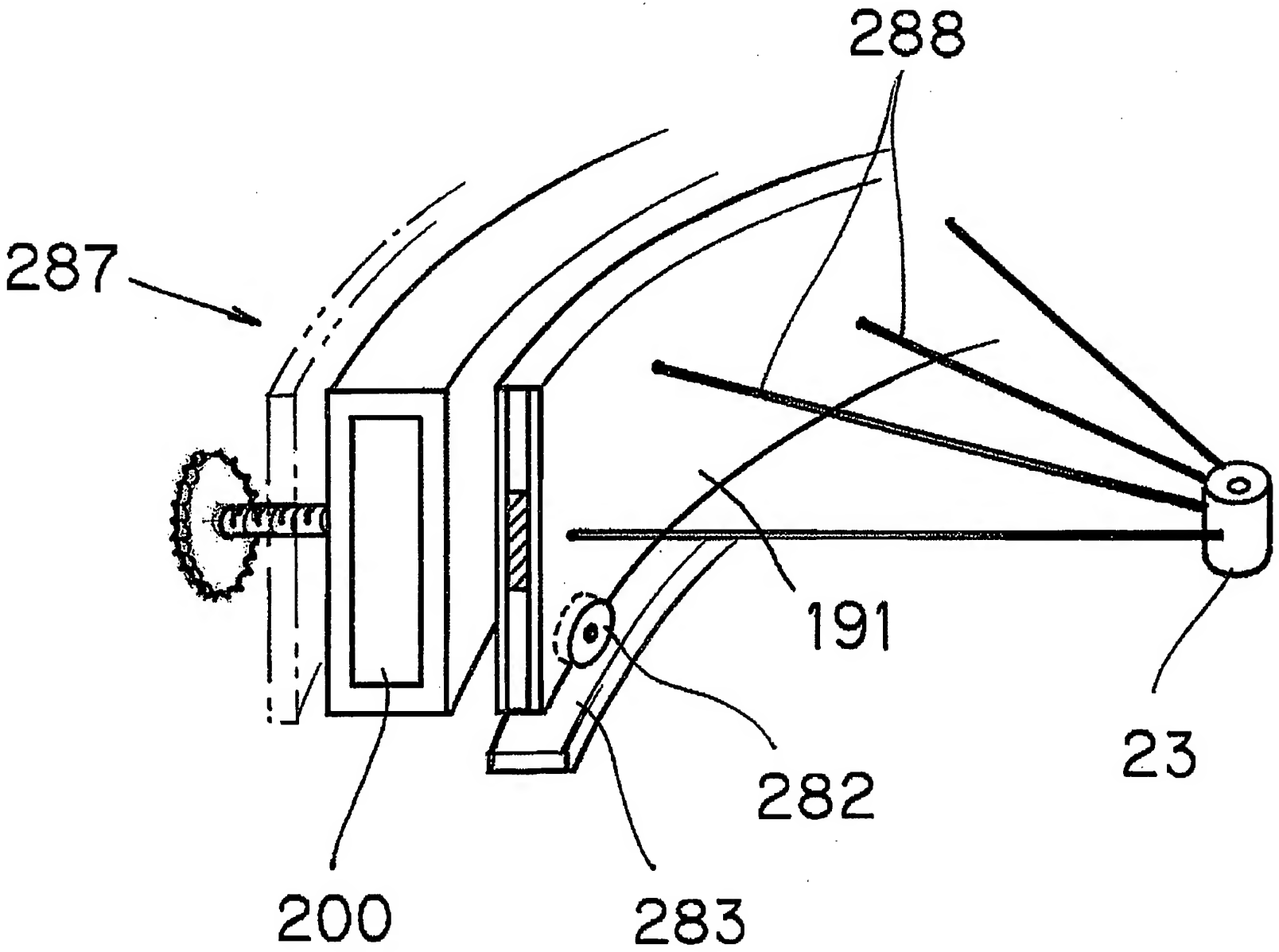


Fig. 78

Fig. 79